Acerca de este libro

Esta es una copia digital de un libro que, durante generaciones, se ha conservado en las estanterías de una biblioteca, hasta que Google ha decidido escanearlo como parte de un proyecto que pretende que sea posible descubrir en línea libros de todo el mundo.

Ha sobrevivido tantos años como para que los derechos de autor hayan expirado y el libro pase a ser de dominio público. El que un libro sea de dominio público significa que nunca ha estado protegido por derechos de autor, o bien que el período legal de estos derechos ya ha expirado. Es posible que una misma obra sea de dominio público en unos países y, sin embargo, no lo sea en otros. Los libros de dominio público son nuestras puertas hacia el pasado, suponen un patrimonio histórico, cultural y de conocimientos que, a menudo, resulta difícil de descubrir.

Todas las anotaciones, marcas y otras señales en los márgenes que estén presentes en el volumen original aparecerán también en este archivo como testimonio del largo viaje que el libro ha recorrido desde el editor hasta la biblioteca y, finalmente, hasta usted.

Normas de uso

Google se enorgullece de poder colaborar con distintas bibliotecas para digitalizar los materiales de dominio público a fin de hacerlos accesibles a todo el mundo. Los libros de dominio público son patrimonio de todos, nosotros somos sus humildes guardianes. No obstante, se trata de un trabajo caro. Por este motivo, y para poder ofrecer este recurso, hemos tomado medidas para evitar que se produzca un abuso por parte de terceros con fines comerciales, y hemos incluido restricciones técnicas sobre las solicitudes automatizadas.

Asimismo, le pedimos que:

+ *Haga un uso exclusivamente no comercial de estos archivos* Hemos diseñado la Búsqueda de libros de Google para el uso de particulares; como tal, le pedimos que utilice estos archivos con fines personales, y no comerciales.

+ *No envíe solicitudes automatizadas* Por favor, no envíe solicitudes automatizadas de ningún tipo al sistema de Google. Si está llevando a cabo una investigación sobre traducción automática, reconocimiento óptico de caracteres u otros campos para los que resulte útil disfrutar de acceso a una gran cantidad de texto, por favor, envíenos un mensaje. Fomentamos el uso de materiales de dominio público con estos propósitos y seguro que podremos ayudarle.

+ *Conserve la atribución* La filigrana de Google que verá en todos los archivos es fundamental para informar a los usuarios sobre este proyecto y ayudarles a encontrar materiales adicionales en la Búsqueda de libros de Google. Por favor, no la elimine.

+ *Manténgase siempre dentro de la legalidad* Sea cual sea el uso que haga de estos materiales, recuerde que es responsable de asegurarse de que todo lo que hace es legal. No dé por sentado que, por el hecho de que una obra se considere de dominio público para los usuarios de los Estados Unidos, lo será también para los usuarios de otros países. La legislación sobre derechos de autor varía de un país a otro, y no podemos facilitar información sobre si está permitido un uso específico de algún libro. Por favor, no suponga que la aparición de un libro en nuestro programa significa que se puede utilizar de igual manera en todo el mundo. La responsabilidad ante la infracción de los derechos de autor puede ser muy grave.

Acerca de la Búsqueda de libros de Google

El objetivo de Google consiste en organizar información procedente de todo el mundo y hacerla accesible y útil de forma universal. El programa de Búsqueda de libros de Google ayuda a los lectores a descubrir los libros de todo el mundo a la vez que ayuda a autores y editores a llegar a nuevas audiencias. Podrá realizar búsquedas en el texto completo de este libro en la web, en la página `http://books.google.com`

This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

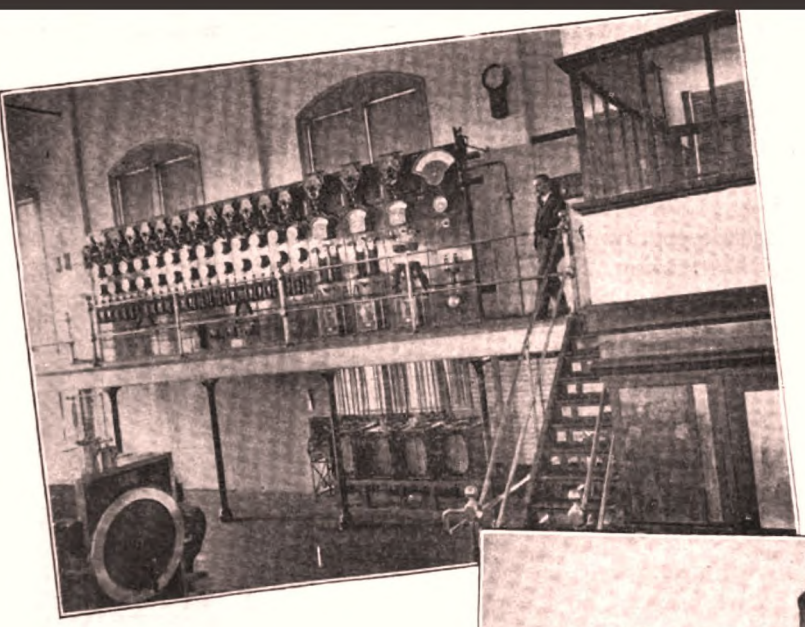
Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

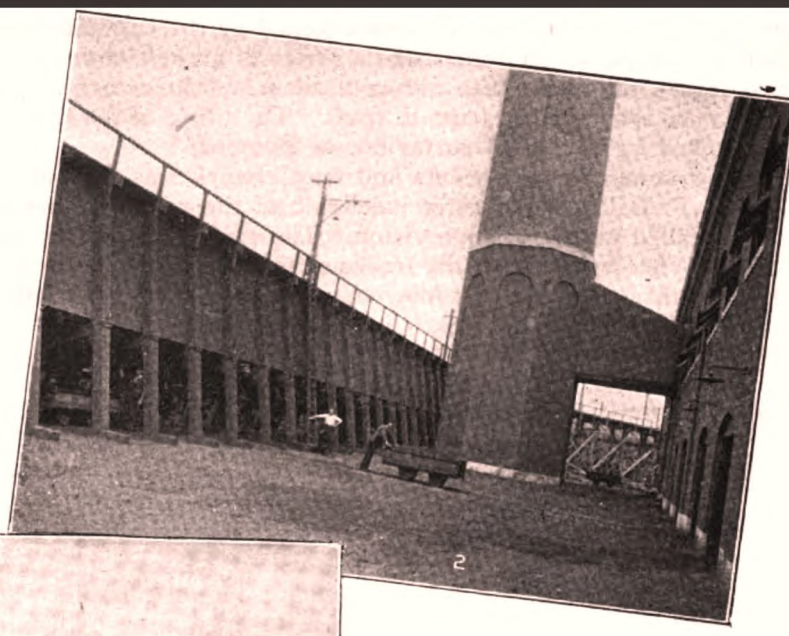
We also ask that you:

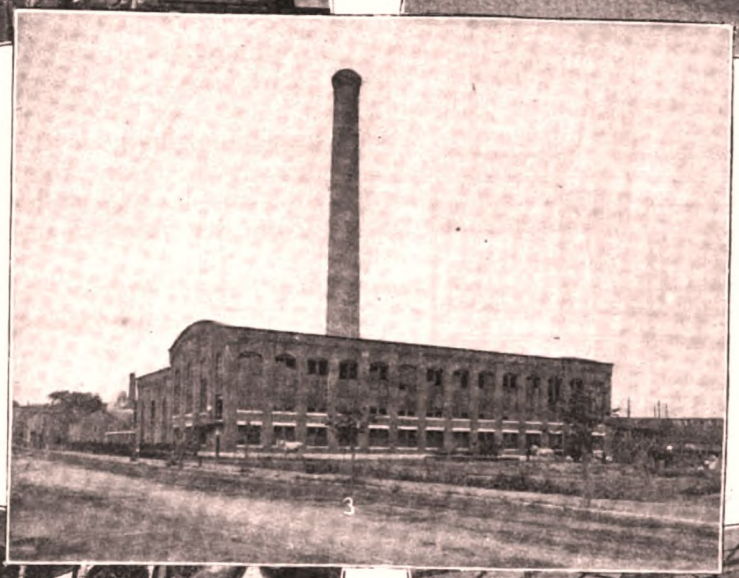
+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

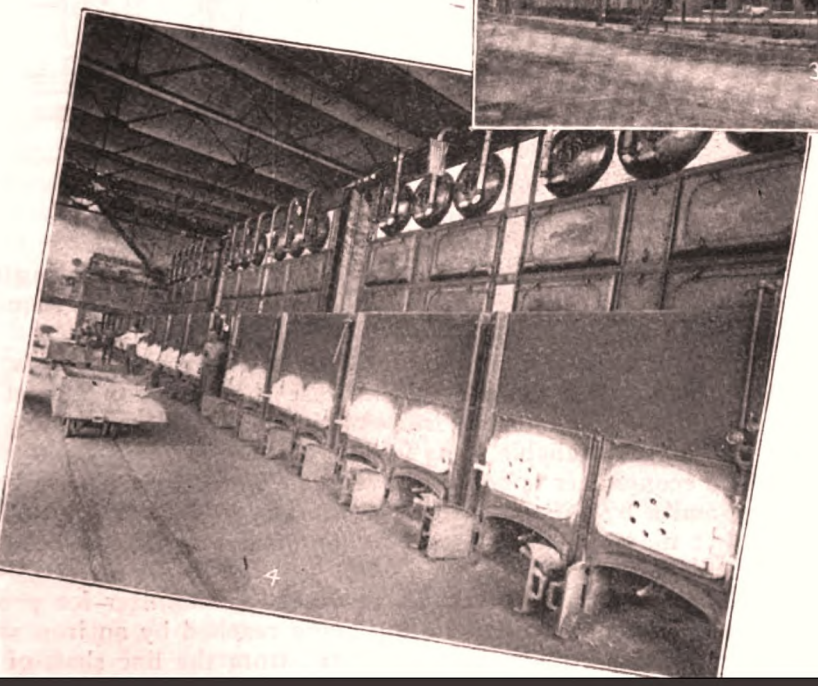
About Google Book Search

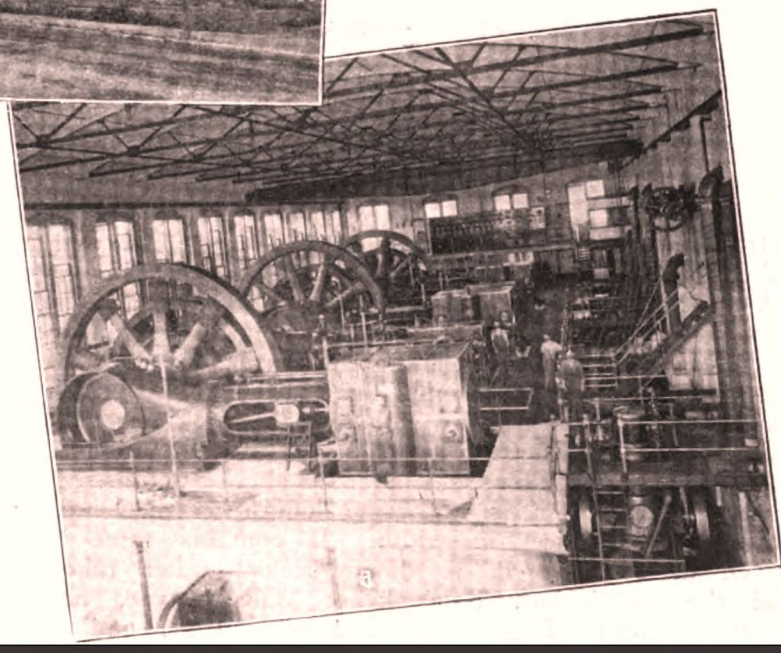
Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`











Electrical engineer

Digitized by Google

Sci 1520.115

LIBRARY

OF THE

LAWRENCE SCIENTIFIC SCHOOL,

Engineering Department.

RECEIVED,
APR 8 1899

SCIENCE CENTER LIBRARY

HARVARD COLLEGE
LIBRARY

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

THE

Electrical Engineer

A Weekly Review

OF

Theoretical and Applied Electricity.

VOLUME XXVI.—1898.

(July to December.)

NEW YORK:

The Electrical Engineer

120 Liberty Street.

Digitized by Google

Bcl 152.1.115

JUN 20 1917
TRANSFERRED TO
HARVARD COLLEGE LIBRARY

Digitized by Google

Alphabetical Index of Contents.

An asterisk (*) denotes Illustrations.

A Running Table of Contents will be found on the last page of each number.

Page.

EDITORIALS.

Alternating Currents to Elec. Traction, The Application of..... 338
Arc Lights, Prices for City..... 486
Armatures, Spare..... 290
Automobiles, The Age of..... 87
Bears and Horses..... 643
Bell Telephones in Use..... 11
Belts, Electric..... 131
Brakes, Agitation over St. Car..... 538
Brooklyn Bridge, Trolleys on the..... 155
Calcium Carbide Industry in Europe, The Present Status of the..... 155
Car Motor Regulation, The Counter E. M. F. Method of..... 83
Central Power Plants, Exhaust Steam from..... 339
Chicago, Elec. Ltg. Consolidation in.... 314
City Light, Legitimate Ways of Getting Cheaper..... 434
Chicago, An Elevated Example from.... 387
College Graduates? What Becomes of Our..... 314
Collisions at Sea, Avoiding..... 106
Conduit Trolley, The Success of the..... 386
Consolidations and Cheaper Current..... 587
Copper Refining, Current Density as a Factor in..... 87
Current, The Waste of..... 315
Dentistry, The Present Status of Electro—..... 86
Detroit Mun. Convention..... 130
Detroit Mun. Elec. Ltg. Plant, The..... 154
Dublin Jarvey, The Trolley and the..... 463
Elec. Ry. Outlook, The..... 234
Elec. vs. Cable Traction..... 642
Electro-Metallurgy, Progress in..... 35
Electricity as the Feeder of the Race... 290
Electrolysis in Ry. Work, Features of... 435
Electrolytic Operations, Recent Progress in..... 131
Enclosed Arc, Popularity of the..... 463
Enclosed Arc Lamp, The..... 563
England, Mun. Telephony in..... 106
England, Municipal Conservatism in..... 642
Engr. Troops, Lack of..... 643
Etherion, The New Element..... 203
Export Trade, Our..... 562
Export Trade, How to Develop..... 586
Export Trade, Phenomenal..... 614
Farm, Isolation of the..... 315
Forbes, Prof., on Long Distance Trans. of Power..... 614
Garb of the Telephone Girl..... 435
German Central Station Statistics..... 130
Glasgow, Mun. St. Rys. at..... 87
Gold from the Sea..... 107
"Greatest Discovery of the Age"..... 515
High Fireproof Buildings..... 615
Hopkinson, Dr. John..... 235
Incandescent Ltg., Exterior..... 615
Indiana, Independent Telephony in..... 59
Induction Generator, Tests with an..... 10
Insulating the Mind..... 435
Jackie Comes Sailing Home, When..... 179
Light Without Heat..... 59
Lighting Corporations, Protecting Well-Behaved..... 131
Manchester Standard Wiring Rules and Regulations..... 386
Manhattan, Moribund..... 178
Motors on Ltg. Circuits, Single Phase and Multiphase..... 203
Motor Before the B. A., The Electric... 410
Mun. Ownership Agitation and its Antidote..... 203
Naming a Specialty..... 615
Navy, An "Electrified"..... 587
Nomenclature and Standardization of Elec. Apparatus..... 10
Office Holder, Everybody an..... 363
Pacific Cable, Building a..... 59
Patent Office, The Work and Needs of Our..... 257
Peace with Honor..... 154
Photometry of the Enc. Alt. Arc..... 338
Pious Founders..... 586
Prejudice Against Machinery, The..... 363
Presidential Addresses, Two..... 562
Price of Current, The Lowering..... 362
Ry. Motor Control..... 58
Refrigeration, Electrical..... 363
Rolling Mills, Elec. Pr. in..... 58
"Rotatory" Converter, A Non-Mathematical Treatment of the..... 538
Sault Ste. Marie as an Elec. Centre..... 34
Scaling Down and Scaling Up..... 179
Scenery, Pecuniary Value of Fine..... 411
"Science Abstracts"..... 315
Search Light and Elecy. in the Navy.... 106
Secondary Cells, The Charging of..... 362
Storage Battery, Novel and Extended Uses of the..... 202
St. Ry. Travel..... 58
St. Ry. Convention, Echoes of the..... 256
St. Ry. Cable, Farewell to the..... 462
Submarine Cables in International Politics..... 387
Surface Contact Railway, The Evolution of the..... 515
Telephone Disturbances from Elec. Generators..... 410
Telegraph Lines in Cuba..... 463
Tesla, Mr. and the Czar..... 486
Tesla, Mr. to his Friends..... 514
Tesla, Mr., His Friends to..... 514
Tornadoes and the Niagara Line..... 339
Traction in a Storm..... 587
Power Trans., The Limitations of..... 202
Treadmill Generators..... 587
Trolley Times, Signs of the..... 34
Trolley and Fan as Health Givers, The.. 235
Uncle Sam Needs More Room..... 411
Volunteer Engr. Corps, Presentation to the..... 87
Volunteer Engrs., Return of the..... 539
War Inventions..... 235
Warning, A Timely..... 487
Warships, Elec. Power on..... 539
Westinghouse-Walker Consolidation, The. 291
Wind Pr. as a Source of Elec. Energy... 339
Wireless Telegraphy, Practical..... 291
Women Car Conductors.....11, 107

AUTOMOBILES.

*"American" Elec. Motor Vehicles, The. 147
Automobiles, Elec. on Fifth Ave., N. Y.. 649
Berlin, Elec. Bus. in..... 488
Boston, Motor Carriage Contests in..... 522
*Cabs, Electric French Tests for City Service..... 102
*Columbia Elec. Motor Carriages..... 80
*Eddy Elec. Carriage Motor, The..... 83
*Elec. Vehicle Co. of N. Y., The Cabs and Central Station of the..... 204
*General Electric Automobile Co., The Vehicles of the..... 442
Horseless, The Hum of the..... 571
"Moto-Vehicle," The Elec..... 531
*Motors for the Elec. Vehicle Co..... 333
*Paris Automobiles, Charging Station for..... 126
*Riker Wagon, A New Delivery..... 578
Vehicles, Cost of Operating Electric.... 79
*Woods' Moto-Vehicles, Elec..... 579

EDUCATIONAL.

Cornell Univ..... 65
Correspondence Instruction, Work of the Elec. Eng. Institute of..... 33
Drexel Ins., Elec. Engineering Course at. 242
Elecy. in Engineering Courses Other Than Electrical..... 200
Elec. Instruction by Mail in N. J..... 348
Lehigh Univ..... 65
Mass. Ins. of Tech..... 542
McGill Univ., More Gifts to..... 643
McGill Univ., Montreal, The New Elec. Equipment at..... 541
McGill University.....114, 161
Michigan Engrs.' Manual..... 65
Mich. Coll. of Mines..... 542
Minnesota, Univ. of..... 65
Nebraska, New Mechanics Arts Hall, Univ. of..... 470
Pratt Institute, Electrical Course at.... 187
Professional Schools, The Correct Theory and Method of Organization of..... 297
Purdue Univ..... 65
Purdue Exponent, The..... 641
Tennessee, Univ of..... 65
Vermont, Univ. of..... 65
Y. M. C. A. Classes..... 320
Y. M. C. A..... 349

ELECTRIC LIGHT.

Alternating Current Transformers, Station Manager's Viewpoint.....36, 61
American Indies Co., The..... 343
Arc Light Circuits, Testing.....232, 293
*Arc Pr. Circuit Lamp, G. E. Enclosed.. 502
Arc with Aluminum Electrodes, E. M. F. of the..... 344
*Arc Lamp, New G. E. 220-Volt Enclosed 541
*Baggett Fuse Repair Screw Driver and Portable Lamp Socket..... 489
Balloon Signalling in Arctic and Antarctic Expeditions..... 389
Baltimore, Md., The Northern Elec. Co. of..... 26
Baltimore, Electricity in..... 5
*Boston Elec. Lt. Co., The New Station.. 505
Brooklyn Edison Management..... 592
Brooklyn, N. Y., Ltg., Affairs in..... 651
Buffalo Gen. Elec. Co. Starting New Machinery..... 522
Carbon Arc Lamps, G. E. Brush Single and Double..... 344
Carboning of Arc Lamps, The Economical..... 187
*Chicago Business Streets, Festoons of Incandescents on..... 605
*Chicago Edison Sta. at Harrison St., New Work..... 508
*Detroit Mun. Elec. Lt. Plant, 1898 Report..... 153
*Enclosed Arc, Miniature G. E..... 327
*Enclosed Arcs, Ill. in Boston and Providence Department Stores by..... 408
*Enclosed Arc Ltg., A few Interesting Pointers Concerning..... 25
*English Ltg. and Pr. Sta. Practice, Features of..... 606
Fire Damp on Inc. Lamps..... 561
*French Chamber of Deputies, A Gas Engine Elec. Ltg. Plant for the..... 559
*Glasgow, Scotland, Mun. Ltg. Plant, Port Dundas..... 51
*Goughnour Dynamos and Motors, The.... 344
*Hull Alter. Arc Lt. Regulator, The..... 53
Jandus Arc Lamp..... 630
*Lamp Holder, Magnetic Inc..... 657
*Lea Enc. Arc Lamp..... 630
*Lieb Park Lamp Post, The..... 357
*Long Beach & San Pedro Elec. Co..... 388
*Long-Schattner Prepayment Meter, The. 591
Lynn Inc. Lamp..... 527
Madeleine, Paris, In the..... 289
*Marine Enclosed Arc. Lamp., G. E..... 603
*Mechanical Plant of a Modern Commercial Building, The.....560, 589, 611, 637
*Meter Tests, Notes on Some Central Station..... 3
Miller Moths, Lights Put out by..... 330
*"Monarch" Enclosed Arc Lamp, The.... 69
Montreal, Ltg. Consolidation in..... 571
*Multiphase System for Cent. Sta. Service, Consideration of the..... 281
Ohio Elec. Lt. Assn..... 186
*Omaha Exposition, Illumination of the Grand Court.....18 42
*Pitman Grove Camp Meeting, Elec. Ltg. at the..... 201
Pittsburg, Allegheny County Lt. Co..... 108
Pittsburg, Knight Templar Illuminations at..... 409
*"Pittsburg" Type K. Transformer, The. 415
Plants, Econ. in operation of Small Light.....233, 292
Price of Current, Reduction by the N. Y. Edison Co..... 357
*Rushmore Marine Generating Set and Projector..... 21
*Rushmore 3-Wire Dynamo..... 465
*Shelby Elec. Co., Inc. Lamps as Manufacturd by the..... 358
Shooting the Chute in a Pr. House..... 433
*Short Circuit, One Way of Finding a... 541
*State Capitol, Wiring the N. Y..... 355
*Sterling Arc Lamp Co., New Lamps of the 88
*Sturtevant Diminutive Generating Set, A. 540
*Switchboards in New Buildings in N. Y.. 343
Tower Blown Down, Elec. Lt..... 433
*Transformers, The Moloney Elec. Co.'s Type A..... 240
Turkey, Ltg. in..... 387
2-Wire Distributing Systems and Lamps. 200-240 Volts..... 52
Vacuum Tubes, Conditions of Luminosity in..... 461
Vapors from the Carbon Arc, On the Elec. Properties of the..... 544
Vitascope, Fire Risk with the, etc..... 466
*Washington, D. C., The U. S. Elec. Ltg. Co., of Its Elec. Equip..... 425
Welsbach Inc. Lamp Filament, The New.. 186
*Welsbach Mantles, Depreciation of Candle Pr. of..... 319
*Wright Discount Meter and Its Use in Central Sta. Management..... 509

ELECTRIC TRANSPORTATION.

*Akron, Bedford & Cleveland R. R. Co., The..... 245
A. S. R. A. Seventeenth Annual Meeting.. 258
Amusement Business..... 371
*"Argonaut," Lake Submarine Boat..... 647
*Baldwin-Westinghouse Elec. Mining Locomotives, The..... 81
Baltimore, Proposed Elec. Consolidation in 533
*Bonner Rail Wagons, The First Train of 534
*Boston Elevated Ry. Co., The Harvard Pr. Sta. of the..... 217
*Boston Subway, The..... 227
Brooklyn "L" Road, Elecy. on..... 387
*Buffalo St. Ry., Storage Bat. Plant of the 53
Buffalo-Niagara Trolleys..... 76
*Buffalo & Lockport Elec. Ry., The..... 228
Calumet Road, Chicago, Improved Shop Methods..... 413
Canal Traction in Europe..... 152
*Canal Haulage, Elec..... 412
Chicago Elevated R. R's., Storage Battery Plants for..... 151
*Chicago, Union Elevated R. R. Pr. House 577
City Traction, The Cost of..... 460
*Cleveland, Painesville & Eastern Ry. Co. 225
*Cleveland, Berea, Elyria & Oberlin Ry. Co..... 222
*Cleveland, O., The Cross-Country Roads at.....221, 245, 285

Digitized by Google

Page.

Conn. Trolley Roads, Financial Condition of ... 518
Country Roads, Elec. Propulsion on ... 220
Dayton, O., Electrolysis of Cast-Iron Water Pipes at ... 441
*Detroit, Ypsilanti & Ann Arbor R. R., The ... 612
*Eberfeld and Barmen, Ger., An Elec. Aerial Ry. Between ... 333
*Elec. Pr. for St. Rys. at the Switchboard, Both Steam and Water Pr., Cost of ... 307
Equipment and Maintenance of Elec. Cars 255, 287
*Evian-les-Bains, Three-Phase Ry. ... 383
*Exhibit Notes of the A. S. R. A. ... 261
Fare Boxes, Individual ... 337
Fresh Air Work by Elec. ... 184
*G. E. Narrow Gauge Ry. Motors ... 104
*Goods Traffic on Our Suburban Trolleys, A Plea for the Introduction of ... 148
*Heilmann, Elec. Locomotive, The New ... 533
Henry "Regenerative" Controller for Elec. Cars, The ... 56
*Herrick's Elec. Car Inspection System ... 220
Honolulu, A Trolley Rd. for ... 488
Inspection and Testing of Motors and Car Equipments by St. Ry. Co.'s ... 288
Italian Rys., Elec. Traction by Water Pr. on ... 460
Japan, Elec. Railroading in ... 533
*Jungfrau Ry. Pr. Plant, The ... 381
London, A Real Trolley Rd. for ... 461
*Lorain & Cleveland Ry., The ... 247
Mail Matter on Inter-Urban and St. Rys., The Carrying of U. S. ... 250
Manhattan Beach, N. Y., Safety Third Rail System at ... 650
Manhattan Elevated ... 524
Massachusetts, Elec. Railroading in Eastern ... 105
*McGurty High Speed Elec. System for Mail and Express Service, The ... 183
*Mont-Dore, France, A Three-Phase Inclined Plane Road ... 648
*Monaco, Surface Contact St. R. R. ... 565
Multiple Unit System, The ... 488
N. Y. Central and its Competitor, "The Trolley" ... 312
*Niagara Falls, The International Trolley Crossing at ... 332
Ohio Canal, Elec. Traction on an ... 42
*Paris, Combined Trolley and Accumulator Traction System in ... 75
Paris Underground Elec. Rd., A ... 580
Paris Exposition, An American Ry. Map for ... 650
Pittsburg St. Rys., Elecy. on the ... 54 76
Poor's Manual of R. Rs. for 1898, Data ... 534
Pr. Plants, By-Products of ... 334
Pr. Consumption in Elec. Railroading ... 152, 184, 230
Prize for an Automobile Accumulator, A Big ... 84
Railway Work, Power Trans. and Distribution for ... 125
Rails, Their Construction ... 459
*Rapid Transit Problem, Some Phases of the ... 77
Richmond Commuters, Trolley Special of ... 518
*Sander Bak. Submarine Boat ... 312
Santiago de Cuba, A Trolley for ... 461
Single and Double Truck Cars for City Use, Comparative ... 251
*South Side Elevated R. R. of Chicago, Str. Bat. Performance ... 368
*Sprague Multiple Unit System on the Chicago South Side ... 444
St. Ry. Engineering, Practical Points in ... 649
Street Railway Receipts in 1896 and 1897. 41
*Surface Contact Elec. Rys ... 516, 530, 564
Survey in the Borough of Manhattan, N. Y. City, An Elec. ... 440
*Third-Rail System as Applied to Electric Propulsion ... 439
*Thompson-Walker Surface Contact Ry ... 382
Track Construction, Points in ... 313
*Track Construction, Defects and Remedy 370
*Waterloo and City Underground Elec. Ry., London, The ... 27
Willard Third-Rail System, Test of ... 255

ELECTRO-CHEMISTRY AND BATTERIES.

Chloride of Silver Dry Cell Battery Co. ... 47
England, Commercial Development of Electro Chemistry in ... 159
*Europe, Electro-Chemical Operations in ... 582
*Extraction, Separation and Refining of Metals, Electrolytical Processes for the—Tommasi Process ... 121
*Teleph. Battery, Western Elec. Sup. Co.'s New ... 422
*Warner's Pocket Battery Gauge ... 475

INVENTORS' RECORD.

43, 67 138, 162, 188, 213, 239, 299, 322, 349 372, 420, 471, 497, 546, 572, 652, 655

LEGAL NOTES.

"Accident" from Stealing Trolley Rides, An ... 188
Child, Value of a ... 162
Cleveland, 4-Cent Car Fares in ... 419
Climax Boiler Patents Sustained ... 395
Collision, Injury from Street Car ... 463
Conduct Controller Patent ... 213

Page.

Flywheel Accident, Responsibility for ... 189
Gen. Elec. Reorganization, Suit to Stop. 162
Inc. Lamps, Lower Duty Collected on ... 463
Jerking of Trolley Cars at Starting is Negligence ... 418
Jerking of Trolley Car, Liability for ... 496
Manila Cable, Damages for Cutting the. 463
Marks and Ransom Patent Sustained ... 419
Marks Enclosed Arc Lamps Method ... 496
Motive Powers on Street Railways, New. 395
Mun. Lighting Plant, Purchase of ... 189
Passenger on Elec. Car Frightened by Flashes, Damages for ... 188
Revenue Stamps on Express Receipts ... 496
St. Louis Kellogg Switchboard, The ... 111
Series-Parallel Controller ... 602
Sterne vs. The Met. Tel. & Tel. Co. and the N. Y. Tel. Co. ... 90
Taxation of Elec. Patents as Property ... 373
Telegraph Litigation, Unusual ... 463
Tesla Patents Invalid in Germany ... 643
T.-H. Elec. Co. vs. Dayton Fan & Motor Co. ... 299
Westinghouse & Thomson-Houston vs. Citizens' Elec. & Diamond Elec. Co. ... 546

LETTERS TO THE EDITOR.

Arc Lt. Circuits, Easy Testing of. J. F. Stevens ... 342
Automatic Motor, Starting Boxes. Raster Carbon Rheostat Co. ... 294
Brush Holders, Some Modern. D. W. Barnes ... 272
Bullock Factory, The Recent Strike in the. J. S. Neave ... 342
California, Water Supply for Pr. in. H. H. Sinclair ... 294
Chicago South Side R. R., Operation of the. Sargent & Lundy ... 440
Collisions at Sea, Preventing. H. Herberts ... 162
Collisions at Sea, Preventing. W. J. Clarke ... 184
Crawfordsville, Ind., City Elec. Ltg. at. F. D. Abraham ... 618
Diagrams, Conventional Electrical. Mr. Tanner ... 112
Dolbear, Prof. on Mr. Tesla and His Work. A. E. Dolbear ... 540
Moribund Manhattan. Chas. Campbell ... 272
Shunt Method of Motor Control. F. J. Sprague ... 134
Spiral vs. Coil Springs. Lamar Lyndon. 272
X-Ray Indications, How Best to Secure Exact. W. J. Clarke ... 59
Yellow Journalism and Society Badges. R. W. Pope ... 294

LITERATURE.

Acetylene, Lighting by ... 129
Alternating Current Wiring and Distribution ... 385
Arithmachinist ... 289
Corliss Steam Engines, Handbook of ... 641
Cuba, Commercial ... 585
Die Elektrischen Lichterscheinungen Oder Entladungen ... 418
Elec. Measurements, Lecture Notes on a Theory of ... 496
Elektrische Licht-und Kraft-Anlagen ... 363
Handbuch der Elektrischen Accumulatoren ... 113
Hilfsbuch fuer die Elektrotechnik ... 363
Kosten der Krafterzeugung ... 418
Laboratory Manual of Electro-Therapeutics, A ... 461
Maver on Underground Work ... 161
Michael Faraday; His Life and Work ... 641
Quantitative Chem. Analysis by Electrolysis ... 161
Radiography, Practical ... 313
Storage Battery, The ... 385
Telephone, The ... 129
Transmission of Energy, Elec. ... 641

MARRIED.

Brayton-Wait ... 35
Cooley-Bogart ... 396
Danforth-Johns ... 498
McCorkle-Howard ... 540
Sykes-Sanborn ... 396
Splitdorf-Urban ... 498
Ward-Clarke ... 11
Wheeler-Sutton ... 396

MECHANICAL.

*Atwood Pr. and Speed Gauges, The ... 300
Boiler Water, Purification of ... 40
*Bullock Central Valve Engines, The ... 20
*Canton Steel Roofing Co. ... 163
*Chimney that Had Outlived Its Usefulness, A ... 41
Cooling Tower and Condenser Installation ... 567
France, Am. Steam Engines Wanted in ... 571
*Gear Cutting Work of Van Dorn & Dutton Co., Cleveland, O., The ... 320
*Hicks Gas and Gasoline Engines ... 628
Jones & Laughlin Co. and the Production of Steel ... 394, 417
*Massillon, O., Russell & Co.'s Engines ... 568
*Pressure Indicator and Pr. Gauge for Engines, A Direct Reading Mean Effective ... 300

*Pumps, Data on the Efficiency of ... 598
*Skinner Automatic Engine and Improved Lubricating System, The ... 39
Steam Boiler Plant, The Influence of Mech. Draft Upon the Operating Expense of a ... 651
*Sturtevant Vertical Engine and Four-Pole Generator ... 620
Worthington Steam Accumulator, Boiler Test Meters ... 158
*Wrought Iron Bridge Co., Canton, O ... 136

MECHANICS FAIR, BOSTON.

*Burton Elec. Smelting Co. ... 468
*Edison Elec. Ill. Co. ... 436
Holtzer-Cabot Apparatus ... 467
*Jandus & Buckeye Elec. Co.'s Exhibit ... 438
Mass. Charitable Mechanic Assn. ... 348, 416
Mechanics' Fair in Boston, The Coming. 160
Miscellaneous Exhibits ... 495
*Moore Vacuum Tube Parlor ... 438
*New England Tel. & Tel. Co.'s Exhibit. 466
*Ridgway Dynamo & Engine Co.'s Exhibit ... 467
*Russell, J. L., Elec. Lt. & Pr. Exhibit ... 439
*Whitman & Couch Teleph. Exhibit ... 468

MISCELLANEOUS.

Acetylene Flame, The Soot of ... 124
Alternating Currents, Methods of Determining the Frequency of ... 416
Alternating Currents, Novel Method of Determining the Frequency of ... 381
*Alternators, High and Low Frequency G. E. ... 472
*Armatures, Practical Balancing of ... 633
British Assn. Meeting, Elecy. at the ... 464
*Commutated Current Wave of a Composite Wound Alternator, The ... 238
*Diagrams, Conventional Electrical, Prof. A. Jamieson's Suggestions ... 37
Dielectric Strength of Air ... 62
*Elec. Gas Ltg., A Wrinkle in ... 635
*Electrometer for Electrical Measurements, A Capillary ... 99
Engineers' Club, The Volunteer Engrs. and the ... 561
Erie, Pa., Theft of Current at ... 239
Exhibition Co., The Elec. ... 545
Export and Import Elec. Trade, Govt. Matters Affecting the ... 542
Fire Extinction in N. Y. City, Radical Changes Necessary in ... 616
*Franklin, A Statue for Philadelphia ... 9
*Hanchett Direct Reading Ohmmeter, The ... 472
*High Frequency Currents, Experiments with ... 464
Hospital Ship "Relief," Electricity on Board ... 9
Inductance or Capacity, Apparatus for Illustrating Change of Phase Produced by ... 237
*Lightning Arresters ... 64
Lighting Stroke, The Current Strength of a ... 401
*Lightning Stroke? Is This a Curious ... 401
*Magnetic Clutch for Heavy Station Work ... 135
Magnetic Iron Ore ... 522
"Mohegan," The Loss of the ... 482
Naval Elec. Engr. Corps, The Necessity for a ... 634
Navy During the War, Elec. & Eng. Work in the ... 617
*Oscillators for Electro-Therapeutic and Other Purposes, High Frequency ... 477
*Paris Exposition of 1900, The ... 402
Paris Exposition Data ... 471
Paris, Transp. of Exhibits to ... 618
Patent and Trademark Revision Committee, The ... 520
Plants, The Action of Elecy. on ... 380
Pulp Bleaching at Muncie, Ind ... 561
*Queen & Co., Phila., High Grade Elec. Apparatus, etc. ... 626
*Refrigeration, Electrical ... 331, 353, 378
Resistance of Iron Wires, The Electrical. 464
Rosenbaum on Electrical Invention ... 481
Self-Induction, Apparatus for Measuring Coefficients of ... 354
*Ship or Iceberg, Means for Detecting the Presence of a ... 97
Silver Plating Plant, Hotel Metropole, N. Y. ... 37
*Tesla Circuit Controllers ... 180
Theatre Party, An Elec. ... 448
Trade Marks on Elec. Apparatus ... 618
Transformer Economy ... 6
*Transformers, Instructions for Testing. 521
Valuable Elec. Invention, A ... 652
Watt, The Illegitimate ... 284
Woodbridge's Elec. Wire Computer ... 302

MUNICIPAL.

Berlin, Mun. Ltg. Row in ... 593
Detroit Convention of the League of Amn. Municipalities ... 132
Detroit is a poor example ... 494
Elec. Pr. Cos' and their Relation to Municipalities ... 645
Haverhill, Mass., A Sweeping Mun. Programme at ... 592
Milwaukee Elec. and the Politicians ... 364
*"Municipal Plant" of Knowledge, The. 542
Mun. Ownership, Some Views and Data on ... 364, 389, 407
Nat. Mun. League, Conference of the ... 592

Digitized by Google

Page.

Newark, O., City Plant Mismanaged.... 57
Penn. Townships Are Run, How Some.. 349
Vienna, The Mun. Gas Fiasco in..... 448

NEWS AND NOTES.

Acceleration of Gravity, Two New Forms of Apparatus for Measuring the..... 273
Axis of the Earth and Freeze Out Spain, To Change the 113
B. & O., Sixty-Foot Rails for 114
Brazil, Demand for Elec. Goods in..... 624
Caracas Warehouse, The 372
*Chicago Peace Jubilee, The Elec. Arch at the 414
Chicago, Activity in 158
*Clambake of the Amn. Elec. Works of Phillipsdale, R. I., 20th Annual..... 273
*Colors for the First U. S. Volunteer Engineers 447
Conduit Laying, Rapid Electric..... 113
Colonies, Elec. Undertakings in Our.... 571
Elec. Energy by the Direct Action of the Atmosphere, Production of 42
Elevator Interests, Proposed Combination of Leading Elec. 537
Etherion 203
Exhibition Next May, Another Elec..... 600
Exports of Elec. Material from N. Y. 491, 544, 571, 599, 623, 651
Fire in N. Y. "Skyscrapers," The Recent Big 590
Fort Wayne Elec. Corporation, Flag Raising of the 114
Glass as a Conductor 65
Hertzian Waves, A New Application of.. 42
Holy Shroud by Elec. Light, Photo of the 65
Lightning and Lightning Arresters..... 650
*Moving Vessels or Vehicles from a Distance, Tesla's Elec. Control of..... 489
Nerve Currents 66
N. Y. & Brooklyn Bridge Terminus..... 158
Niagara Elec. Engrs. in the War..... 114
Paris Exposition, Regulations at the.... 491
*Paris Exposition of 1900, The..... 594
Paris Exposition, Space at the 447
*Phila. Peace Jubilee, Elecy. in the..... 444
*St. James Portable Elec. Burglar Alarm, The 392
*Spanish-Amer. War, The Use of Elecy. in the 392
*Stable, Elecy. in a Modern 10
Struck by Lightning Two Hundred Times 492
Torpedo Militia 650
*Turn-Table, Westinghouse Elec. 185
*Vol. Engr. Corps, First Regt. U. S..... 156
Water Purification, The Louisville Experiments in 491

OBITUARY.

Adams, Dr. W..... 653
Brown, E. D..... 85
Brown, Jas..... 624
Colton, Dr. G. Q..... 161
Clark, L.....498, 523
Davenport, C. G..... 435
Dennis, H. F..... 471
De Meritens, A..... 498
Faure, C. A..... 435
Herz, Dr. Cornelius..... 66
Hopkinson, Dr. John..... 214
Jackson, J. M..... 85
Keely, J. W..... 523
Miller, H. B..... 498
McDonald, R. T..... 653
Newton, Mrs. C. E..... 11
Richmond, G. B..... 161
Schoenleber, J. J..... 161
Summers, C. H..... 471
Spencer, H. S..... 498
Whitmore, F. C..... 654

PERSONAL.

Edwards, Capt. Robt., Jr..... 238
*Griffin, Col. Eugene, Dinner of the First Vol. Engr. Regiment to..... 600
*McDonald, W. C..... 624
Reminiscences and a Glimpse into the Future, Prof. Elisha Gray..... 38
Röntgen to go to Leipsic..... 545
*Sergeant, C. S..... 321
Stieringer, L., A Gold Medal from Omaha 545
Weaver, Lieut. W. D., Dinner to..... 522

POWER TRANSMISSION.

*Amn. Engine Co.'s Direct-Coupled Elec. Motors 658
*Barton, Vt., A 14-Mile Monocyclic Transmission 49
*Bernard Enclosed "Barrel" Motors and Generators 470
*Bleaching and Dyeing Est., Prov., R. I., Alternate-Current Motors in a..... 159
Bridge Construction by Elecy..... 581
*Buffalo, New Transformer Plant for Niagara Pr..... 100
Canon City-Cripple Creek Plant..... 231
*Canon City, Colo., Elec. Pr. Co.'s Station at..... 377
*Chicago Pub. Library Dumb Waiters.. 329
*Conkey Printing Establishment, The Elec. Equip. of the.....469, 482 510
Denver, Transmission at..... 581
*Door Openers for Elevators..... 806

Page.

*Emerson Laboratory Motor 525
Fraser Elec. Elevator, The..... 585
Fraser Elec. Elevator, The..... 585
*G. E. Co.'s 160 H. P. Motor..... 278
*Growth of Elec. Pr. Trans., The..... 511
*Hamilton, Can., The Cataract Pr. Co.'s Plant at De Cero Falls..... 553
*Hartford, Conn., The New Veeder Cyclometer Factory..... 32
High Voltage Pr. Trans....519, 535, 557, 580
Hoosac Ry. Tunnel, Ventilation of..... 482
*Iron Clad Motor, Commercial Elec. Co.'s 68
*Kent Battery Fan Motor 70
Linoleum Factory, Elec. Pr. in a..... 574
Long Distance Trans..... 199
*Mechanicville, N. Y., Three-Phase Trans. 193
*Niagara Falls, Work by the Hyd. Co... 73
*Niagara, New Power Cable Conduit at.. 492
*Niagara Power House, Enlargement of. 170
*Niagara, Calcium Carbide Works..... 371
Niagara Pr. Development in Canada..... 556
*Niagara Pr. in Canada, The Development of..... 636
Power Station, The Abuse of the..... 75
*Prospect Park Incline, Niagara, Operation by Elecy. of the..... 511
*Pump Outfit in a Calif. Winery..... 295
*Pump Outfit, Worthington Elec..... 399
*Reno Inclined Elevator in a Store, The. 1
*St. Joseph Sanit. Plant, The..... 305
*Sewing Machine, New German..... 101
*Snoqualmie-Seattle-Tacoma Trans. with Aluminum Line Wire, The..... 169
South. Water Pr. Plants in the..... 232
Taunton, Mass., Tack Works..... 135
Welland Pr. Canal, The..... 75
*West Superior, Wis., A Novel Pr. Trans. Scheme for..... 408

REPORTS OF COMPANIES.

Brooklyn Edison Co., Sale of 67
Fort Wayne Lamp Co. 654
Gen. Elec., Outlook for 44
Gen. Elec. Stock Scaled Down $20,000,000 .....92, 189
Mullinix Elec. Co. 44
Narragansett Elec. Ltg. Co. 396
Nassau Electric Railway..... 44
New Orleans Traction Co..... 373
N. Y. Gas & Elec. Lt., Ht. & Pr. Co., The. 373
Pelton Eng. Co. 654
Phoenix Carbon Co. 44
Pittsburg United Trac. Co..... 162
Stanley Co. in the West, The..... 300
Union Traction Co..... 92
Wenstrom Co., Sale of the..... 654
Western Union 396
Westinghouse Retirement of Floating and Bonded Debt 162
Westinghouse & Walker Interests, A Deal Between 300
Westinghouse-Walker Consolidation, Details of the 322

ROENTGEN RAYS.

Cathode Rays, The Magnetic Deflection of Diffusely Reflected..... 461
Cathode Surfaces, Mutual Influence of... 513
Coal, Testing the Purity of, by X-Rays.. 134
Corpuscular Theory of Röntgen Rays.... 513
Currents Generated by Röntgen Rays... 641
*Edison Portable Cabinet X-Ray Outfit, The 295
Emission, Duration of Röntgen Ray ... 640
Fessenden X-Ray Apparatus, The..... 38
Gold Quartz by the Röntgen Rays, Testing 66
*Kolle Telescopic Fluoroscope, The..... 622
Lighting Effect, A Possible X-Ray..... 133
Polarization of Elec. Radiation..... 640
Polarization of Röntgen Rays..... 134
Röntgen Rays, Speculations Concerning. 367
Röntgen and Cathode Rays, Difference Between 640
Vacuum Tubes vs. Coherers..... 640
X-Ray Apparatus, The Decreasing Demand for..... 133
X-Ray Work, Some Recent..... 237
*X-Ray Work in Baltimore..... 340

SOCIETY AND CLUB NOTES.

Am. Assn. for the Advancement of Science 212
A. A. A. S. and S. P. E. E..... 112
A. I. E. E.....35, 348, 419, 448, 523, 545
Am. St. Ry. Assn.....134, 160, 211
Am. Soc. Mech. Engrs.....523, 570
St. Ry. Accountants' Assn. Meeting, The 271
Canadian Elec. Assn. 35
Chicago Elec. Assn. 523
Conn. St. R. R. Assn..... 545
Conn. Elec. Ltg. Assn..... 623
Dental Soc., Elecy. at the 28th Annual Meeting of the N. J. State..... 89
Edison Ill. Co.'s, Assn. of.....238, 271, 298
Education, Eng. 42
Elec. Trades Soc. of N. Y..... 623
Electro-Therapeutic Assn., Buffalo, N. Y. 346
Electro-Therapeutic Assn., American.112, 238
Engineering Societies, Journal of the Association of 373
Engineering Education, Society for the Promotion of 187
Fire & Police Superintendents' Convention 160

Page.

Guide Book, Free 272
Independent Telephone Assn. Meeting... 271
Maritime Elec. Assn., The 271
Merchants' Assn. of N. Y..... 112
Mo., Independent Teleph. Assn..... 571
Mun. Electricians' Assn. 348
Nat. Elec. Credit Assn..... 395
Navy, Line and Engr. Officers in the.... 622
N. Y. Elec. Soc.....35, 419, 448, 545, 602, 622
N. Y. State St. Ry. Assn., Manhattan Beach Meeting 297
N. Y. State St. Ry. Assn..... 238
Northwestern Elec. Assn. 653
Ohio Elec. Lt. Assn. 134
Omaha, Old Time Telegraphers at..... 321
Omaha, Meeting of Elec. Engrs..... 17
Underwriters' Nat. Elec. Assn..... 623
Va. St. Ry. Assn..... 653
Westinghouse Banquet to the N. A. S. E. 299
"Wireless Telegraphy," Chicago Elec. Assn. and 653

TELEGRAPH.

African Tel. Scheme, Another Big..... 61
*Baltimore, Md., The Fire Alarm Tel. System of..... 316
Block Island, R. I., Gov. Cable to..... 60
Cuban Cables, Claims for Cutting..... 589
Cablegrams, Penny Rate Proposed for.. 567
Cape Town to Cairo, The Teleg. Line From 494
*Fire Alarm System, Motor Generators for the Chicago..... 146
*Coherer in Warfare With a Word on Balloons, The..... 588
Cuba Submarine Teleg. Co., Some Figures from the..... 619
Cuba and Porto Rico, Telegraphy in..... 588
Cuba, A New Teleg. Line for..... 367
Fire and Police Tel. Lines, Aerial Construction of..... 200
Fire Alarm Tel. Protection, Advance in. 176
Fleming Plan for Imperial Cables, The.. 644
*French Atlantic Cable, The New..... 457
*Kansas City, Mo., New Pos. Tel. Headquarters in..... 492
Klondike, Telegraphy in the..... 391
Marconi Wireless Telegraphy in England, Recent..... 60
*"Morse-Watch," The, A Secret Tel. Sounder 365
Municipal Tel. Chiefs to Meet..... 85
Pacific Cable Schemes..... 84
Porto Rico, The Tel. in..... 236
*Postal Tel. Co.'s Caravan..... 529
Santiago Cable, Government Controls the 84
*Submarine Telegraphy and Cables, The Development and Present Status of... 453
Tax Fight in Kansas Tel..... 200
Tax, Payment of Telegraph..... 128
Telegrams, Sender Must Stamp..... 60
Telegram Stamp Tax, The Collection of the 619
Telegraph Tax? Who Shall Pay the..... 84
*Telelectroscope, The Szczepanik..... 14
Western Union Figures..... 319

TELEPHONE.

Arc as a Telephone, The..... 60
Baltimore, Md., The Chesapeake & Potomac Teleph. Co..... 29
B. & O. Long Distance Telephony for the 317
Bell Telephone Output 136
Bell Teleph. What it Owns..... 644
Bell Telephones, Large Output of..... 367
Bell and Independent Combine in the Northwest, A..... 318
Bell Tel. Commissions Waiving..... 318
*Boston Exchange District of the N. E. Tel. & Tel. Co., The..... 390
Brussels, Belgium, A New Teleph. Ex. for 566
Cape Colony Telephones in..... 177
Carty's Telephone Bridging Bell..... 91
*Chicago Teleph. Ex. Common Battery System for..... 318
Cincinnati, O., Competitive Telephony for 645
"Citizen" and "Bell"..... 60
Cleveland, Independent Telephony in.... 391
Columbus, O., Report Against Municipal Telephony at..... 85
England, Municipal Tel. in..... 237
Greater N. Y., Competition in; The Peoples Teleph. Co..... 390
Harlem Ex. of the N. Y. Teleph. Co., The Novel Switchboard at the..... 512
Hotels, The Telephone and the..... 84
Independent Teleph. Assn., Chicago; Second Ann. Convention..... 15
Iowa, Independent Teleph. Combination in 110
Iowa, Independent Toll Line Telephony in 177
*K. R. Law, Limiting Distance of Teleph. Speech and the..... 406
*Large Offices, Intercommunicating Teleph. System in..... 493
Line Signal, The Evolution of the Teleph. 13, 28
Mansfield, O., A Farmers' Co-Operative Teleph. System Around..... 294
Maryland, Independent Telephony in.... 128
McKeesport, Pa., Teleph. "Alarm

Digitized by Google

INDEX.

Page.

Clocks" at..... 644
Michigan, Farm Tel. in..... 128
Mich. Independent Telephony in..... 177
New Brunswick, N. J., An Arrest by Telephone at..... 342
*Newport, R. I., The New Teleph. Ex. at..... 458
N. Y. City, Teleph. Opposition in..... 567
Nineteen Hundred Mile Circuit..... 620
Packing Houses, Private Teleph. for.... 567
Paris, Govt. Pay Teleph. Stations in.... 530
*Pittsburg Cent. Dist. Co..... 145
Ries Teleph. System, The..... 644
Russia, Telephony in..... 60
St. Petersburg and Moscow, Telephony Between..... 60
*Schmidt Movable Teleph. Arm Without Connection Cord, The..... 494
Slot Telephones in Chicago, Illegality of. 391
*Stockholm, Sweden, Overhead and Underground Teleph. Work in..... 32
*Stone Telephone Repeater, The..... 236
Telephones and Liquid Air..... 66
Telephone Tolls in N. Y. City..... 600
*Telephone Work, Practical Features of.....12, 31, 108, 127
*Timing Calls in Teleph. Exchanges..... 171
Toll Tax, The Telephone..... 85
*Victor Apparatus..... 110
*Victor Express Switchboard, The..... 366
Washington Rates, Congress Fixes..... 177
*W. & C. Receiver, The..... 319
West Indies, Lines in the..... 644
*Wire, Hard-Drawn Copper, The Introduction of..... 317
*Worcester, Mass., The New Teleph. Ex. at..... 364

TRADE NOTES.

*Burton Elec. Welding, Forging & Brazing Machine, The..... 93
*Cabinet Mfg. Co., Steubenville, O..... 142
Capitol, Wiring the N. Y. State..... 45
*Central Elec. Co., The New Home of the 503
*Circuit Breaker, New La Roche..... 449
*Cleveland, O., Repairing a Ry. Generator Armature..... 69
*Cleveland Elec. Co..... 141
*Cleveland Armature Works..... 303
*Clocks, Standard Elec..... 164
*Compensator for Series Incandescents, Gen. Elec..... 70
*Cutler-Hammer, 500 H. P. Starting Box 423
Duquesne Galvanizing Co., The..... 242
*Edison Store on Upper Broadway, N. Y. 46
*Flush Plug Receptacle, Zimdars & Hunt's..... 350
*Forest City Elec. Co., Cleveland, O..... 277
*Franklin Elec. Sup. House, Phila., The. 114
*Frink's Patent Reflectors..... 474
*Fuse Block and Lightning Arrester.... 165
*Gold's Elec. Car Hfg. Apparatus..... 140
*Gold Elec. Heaters..... 501
*Goodsell's "98" Pump Packing..... 473
*Hart, H. & H. Push Switch.....324
Harrisburg, Pa., Foundry & Mach. Co... 45
*Heater, Western Elec..... 397
Holtzer-Cabot Gas Engine Igniter, The.. 95
*Holtzer-Cabot Automatic Burner, Improved..... 69
*Homer & Co., Cleveland, O..... 241
*Horn & Brennen Mfg. Co., Phila., Pa., Lighting Fixtures of..... 490
*Hubbard-Mortson Time Switch, The... 93
*Jewell Resistance Rods..... 327
*Kelsey Noiseless Ratchet Brake..... 450
*Lamp Guard, Inglis Improved Perfection 549
*Leonhardt Wagon Mfg. Co., of Baltimore..... 166
*"Loricated," The Safety Conduit..... 94
*Magnetic Blow-Out Automatic Circuit Breakers, G. E..... 325
*Metal Work of J. H. Eller & Co., Canton, O..... 115
*Mica and Micanite, India..... 275
*Ohio Brass Co.'s Ry., Appliances..... 276
*Panel Board, Zimdars & Hunt..... 398
*"Provo" Insulator, The..... 657
*Pump, Davidson Vertical Triplex..... 22
*Rail Joint Mfg. Co., Cleveland, O..... 274
Rheostats, Imperial..... 524
*Shadeholder, Housatonic Co.'s "Ideal".. 23
*Speaking Tube, Western Electric..... 326
*Standard Paint Factory, Hamburg..... 474
*Sturtevant Fan, The..... 374
*Tile Bolt and Lock, Western Elec..... 629
*"Victor" Circuit Breaker, The..... 397
*Vought Inc. Lamp Hanger, The..... 398
*Wheeler Porcelain Enamel Deflector for Street Lamps, The..... 326
*Williams Elec. Co., Cleveland, O..... 116
*Zimdars & Hunt Switch & Motor Starter..... 549

AUTHORS.

Abbott, A. V.....13, 28
Abbott, H..... 171
Allen, A. H..... 412
Armstrong, A. H..... 77
Asher, J..... 229
Atwood, G. F..... 300
Aydon, J. W..... 176
Balcombe, M..... 18
Berg, E. J.....125, 199
Bonner, W. T..... 148
Bowie, G. W..... 553
Brown, H. P..... 441
Bruce, E..... 389
Brush, C. F..... 203
Bryan, W. H.....560, 589, 611, 637
Burgess, C. F..... 99
Clarke, W. J..... 187
Conant, R. W..... 307
Cook, E. H..... 380
Cravath, J. R.....368, 413, 488, 635
Damon, G. A.....469, 482
Dimmock, W. S..... 250
Dobbs, A. E.....12, 31, 108, 127, 541
Dodd, S. T.....152, 184, 230
Drake, F. E..... 594
Dunlap, C.E..53, 73, 100, 170, 228, 312, 332, 636
Ennis, W. D..... 3
Fairchild, C. B.
5, 29, 54, 76, 145, 221, 245, 285, 340
Fay, T. J.....331, 353, 378
Fenner, Dr. M. M..... 334
Forbes, F..... 618
Gibbon, T. H..... 370
Goldsborough, Prof. W. E..... 6
Gray, Prof. Elisha..... 38
Grier, T. G..... 392
Griffin, Col. E..... 650
Hallberg, J. H..... 25
Hanchett, G. T..... 633
Harding, W. A..... 649
Henry, J. C..... 56
Herberts, H..... 97
Herrick, A. B..... 220
Holmes, W. H..... 371
Hood, B..... 201
Hopkins, M. S.....255, 287
Hopkins, H.....364, 389, 407, 542
Howell, J. W..... 52
Hunter, R. M..... 442
Jackson, J. P..... 200
Johnson, E. H.....516, 530, 564
Kelley, W. S..... 281
Knudson, A. A..... 440
Kolle, F. S..... 622
Lang, A. E..... 645
Markland, W. H.....232, 293
Maxham, L. M..... 439
McCulloch, R..... 251
McNair, A. D..... 242
Merritt.....461, 464
Morgan, J. L..... 284
Morland, S. T.....237, 354
Moxham, A. T..... 459
Perkins, F. B..... 288
Roberts, E. P.....233, 292
Roller, F. W..... 634
Scott, C. F.....519, 535, 557, 580
Shepard, E. M..... 444
Snow, W. B..... 651
Sprague, F. J..... 588
Steinmetz, C. P..... 62
Tesla, Nikola..... 477
Thompson, W. H..... 200
Thurston, Prof. R. H..... 297
Tommasi, D..... 121
Vail, J. H..... 567
Weaver, W. D..... 617
Webb, H. L..... 453
Weller, H. W..... 217
Wetmore, J..... 616
White, W. F.....36, 61
Woods, C. E..... 531
Woodward, F. L..... 367
Woodward, Prof. R. S..... 273
Wurts, A. J.....64, 401

Digitized by Google

Digitized by Google

Digitized by Google

The Electrical Engineer.

Vol. XXVI. JULY 7, 1898. No. 531.

The Reno Inclined Elevator in a Department Store.

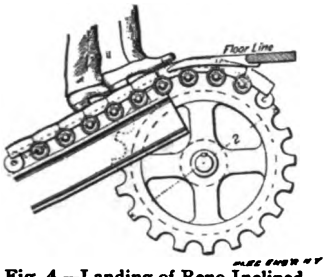


Fig. 4.—Landing of Reno Inclined Elevator.

ANYONE who has seen and wondered at the restless activity and untiring energy of modern shoppers will welcome any means whereby their task or perhaps his own will be made lighter and the number of miles to be walked be lessened. Not alone would a one-story department store find favor or horseless carriages on the floor be in constant demand, but elevators for which the wearisome shopper would not have to wait five minutes or more might receive hearty approval. Recognizing these facts and to lessen as much as possible the fatigue of their customers, the well-known department store of Bloomingdale Bros., occupying the entire block between Fifty-ninth and Sixtieth streets, on Third avenue, New York, has been enriched lately by the installation of one of the greatest conveniences yet devised for the comfortable handling of large masses of people circulating indoors. It consists of the Reno inclined elevator, described and illustrated below, which will be remembered by our readers as having been in use for some time on the Brooklyn Bridge and at Coney Island, 200,000 people having been transported by it at these two places without a single mishap. We may here state that since the elevated trains have begun to run over the Brooklyn Bridge the Elevated Railway Company are seriously considering the installation of a Reno elevator at the New York terminal of the bridge.

The Reno inclined elevator, which may be said to fill the void between a common stairway and a vertical elevator, is installed near the main entrance of the colossal establishment, and leads from the first to the second floor of the main building. Since it has been put in place over 50,000 persons have taken advantage of this novel device, and not a single accident has occurred, and, so far as we can see, there is not the remotest chance of the youngest or weakest person being injured or even alarmed in stepping on it for the first time. During the ride on this incline the sensations of the passengers are apparently more agreeable than when shut up in the closed cage of an ordinary elevator.

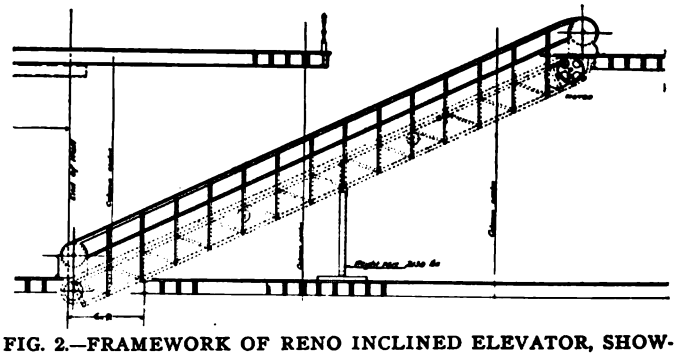


FIG. 2.—FRAMEWORK OF RENO INCLINED ELEVATOR, SHOWING LOCATION OF MOTOR.

The elevator, shown loaded with a number of passengers in Fig. 1, is built against the wall of the building, where space could well be spared and where, as can be seen, it does not rob the floor of valuable sale room. It is 3½ feet in width, being intended for single-file service, and is built at an angle of about 25 degrees, as shown in Fig. 2. Referring to this figure, it will be seen that the structure consists of steel framework, bolted at the top to the steel floor beam or header, and similarly supported at the bottom. Near the middle it is supported by a steel column, the weight at that point being about 2,100 pounds. The moving incline consists of an endless chain, marked a in Fig. 3, rotated by a sprocket wheel b, to which are attached a number of hardwood slats, c, which are plainly shown in Fig. 5. These slats have fastened to them a series of rubber-covered ridges, d, each being about ¾ inch wide and 1 inch high. These serve as a comfortable footing for the passengers and also insure a perfectly smooth, safe landing at the upper end of the machine.

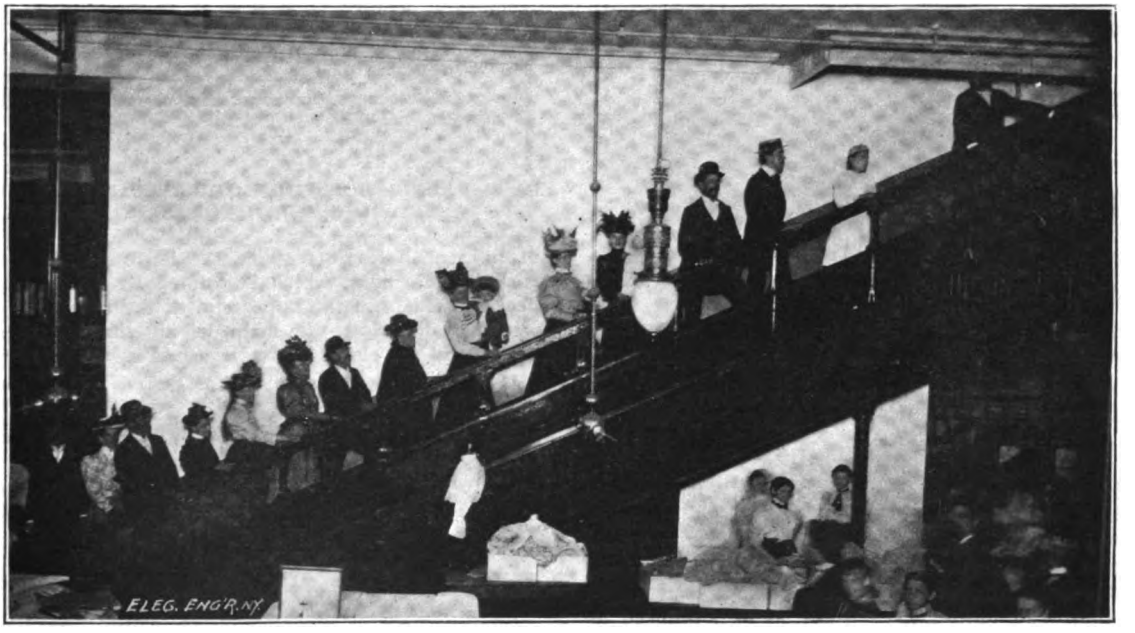


FIG. 1.—SIDE VIEW OF RENO INCLINED ELEVATOR, FULLY LOADED.

Digitized by Google

This is accomplished in the following manner, shown in Fig. 4. The feet of the passenger, which rest upon these rubber-covered ridges, are slid off as they arrive upon a comb-shaped landing, consisting of cast-iron prongs, which fit into the grooves separating the ridges d. The landing is a most agreeable and natural one, and forms a very essential portion of the machine. So perfect, in fact, is the action that even cotton waste will not catch at this point.

To each end of the wooden slats is attached a small anti-friction wheel e, made of hemasite. These roll upon the angle iron f and are also shown in Fig. 4. As will be seen, these wheels roll upon the angle irons on both their upward and downward passages and insure easy running, free from shocks and jars.

The endless chain a, besides passing over the sprocket wheel b at the upper end of the machine also passes over an idler sprocket wheel at the lower end, as shown in Fig. 2. Attached to the shaft of the upper wheel is a cut gear g, into which meshes

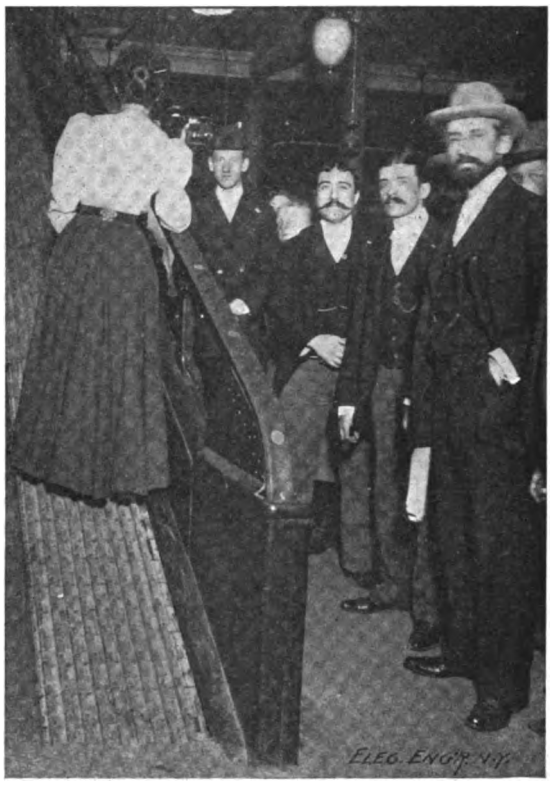


FIG. 5.—FRONT VIEW OF RENO INCLINED ELEVATOR, SHOWING CONSTRUCTION OF MOVING INCLINE AND HANDRAIL.

a rawhide pinion h attached to a countershaft. This shaft carries at its other end a similar cut gear i, into which meshes another rawhide pinion j, which is attached to the motor shaft. There are thus obtained two reductions in speed, each set of gears reducing the speed one-sixth, or a total reduction of one thirty-sixth. The speed of the motor, 450 r. p. m., is thus reduced to about 12 r. p. m. at the chain, which gives the moving incline a speed of 75 feet per minute.

The motor used to drive the mechanism is of the C & C iron-clad type, shown in Fig. 6. It is a 15 h. p. machine, but its winding has been changed so as to make it a 10 h. p. machine at 450 r p. m. on a 110-volt circuit. As will be shown later, the maximum load on the elevator only requires a motor of one-half that capacity. The motor is bolted to the floor beams at the upper end of the elevator, as shown in Fig. 2, and is controlled by an automatic starting box, housed in near the lower end. To the switch of this starting box is attached a cord which leads to the upper and lower ends of the elevator, and by means of which the motor may be started, stopped or reversed.

Another essential feature of the elevator is the moving handrail, which is shown in perspective in Fig. 5 and in section in Fig. 3. Referring to this figure, the railing is supported on stanchions, k, placed every 3 feet apart, of a shape and fastened in the manner shown. To the tops of these standards is bolted the steel bar l, which has cut into its upper surface a

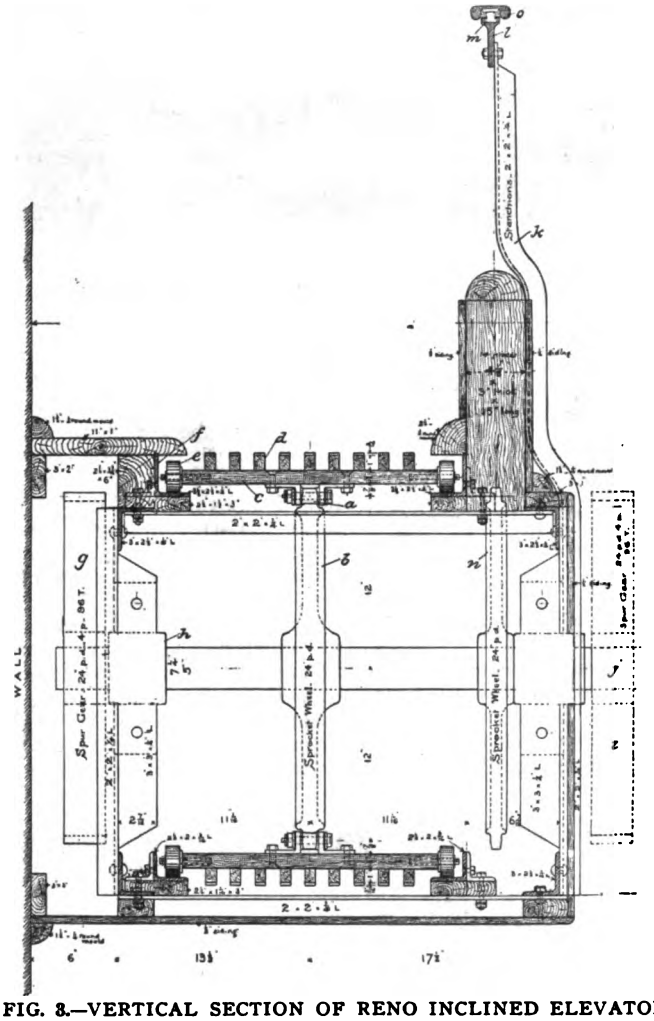


FIG. 3.—VERTICAL SECTION OF RENO INCLINED ELEVATOR, SHOWING DETAILS OF CONSTRUCTION.

slot m. In these slots slides the bottom of a specially constructed steel chain, which is rotated by means of a sprocket wheel marked n, at the upper end of the machine. This wheel is attached directly to the main driving shaft of the elevator, so that the rail travels at the same speed as the platform, and the

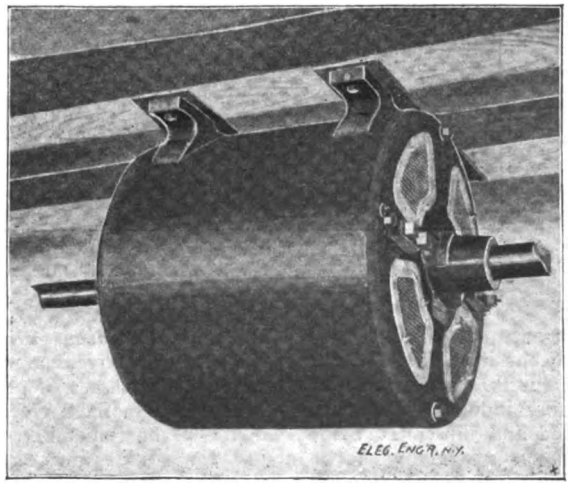


FIG. 6.—C & C OPEN TYPE MOTOR, USED FOR RENO INCLINED ELEVATOR.

two appear stationary with repect to each other. There are also two idler sprocket wheels, one at each end, which are enclosed in casings, as shown in Figs. 2 and 5. The chain, which if once

Digitized by Google

lubricated remains so by its own motion, is covered over by a moulded rubber covering o, to which it is securely fastened, and serves as the support for the hand of the passenger. Due to the noiseless running of the machinery, it was found necessary in order to advise people of the fact that the handrail was in motion to mould into the rubber large round white discs, which are plainly visible in Fig. 5.

As has been stated above, the moving platform travels at the rate of 75 feet per minute, or, if run continuously for ten hours, it will cover about nine miles in one day. The elevator, when fully loaded, i. e., counting one passenger for every two feet, will carry thirty-seven in one minute, or 2,200 in one hour, To find the power and from this the cost of transporting this large number of people, a very exhaustive series of tests were undertaken last week, with the following results:

Volts.	Amps.	H. P.	Remarks.
110	8.2	1.2	Elevator free.
110	16.0	2.36	5 people on elevator.
110	19.0	2.8	9 people, 5′ apart.
110	20.0	2.95	11 people, 4′ apart.
110	35.0	5.15	21 people, 2′ apart.

Reckoning the power to cost three cents per h. p. h., it would cost seven cents to carry 1,000 passengers in one hour, which appears to be by far the cheapest means of transportation available at present.

Besides its low cost of operation, the following advantages are claimed for the elevator.

1. It makes the second floor of store buildings almost as accessible to the public as the ground floor.
2. It takes up little valuable space, and, as shown in the above installation, may be located adjacent to the wall.
3. It fulfills the fire department regulations as to a stairway, and thus does away with the stairs needed in addition to an ordinary elevator.
4. It requires no attendant to run it.
5. It is noiseless.
6. It may be started or stopped at either end by simply pressing a button.
7. It is always ready for use.
8. It will handle boxes and trunks.
9. It consumes power only in proportion to the number of passengers elevated.
10. It is absolutely safe.

Mr. J. W. Reno, the inventor of the elevator, is a mining engineer, having graduated from Lehigh University in 1883. He then went West to engage in mining work and remained there for seven years, when he came East and went into the mining department of the Thomson-Houston Company, working together with Captain Griffin and Mr. Van Depoele. He had charge of the building of several trolley roads in the South. He then took up the subject of inclined elevators, which he has brought to the stage of perfection, evidenced by the installation described above. He has also worked out during the past few years an underground railway system which appears to admirably suit the conditions found in this city.

ELECTRIC LIGHTING.

Notes on Some Central Station Meter Tests.

BY WILLIAM D. ENNIS, M. E.

THE writer recently had occasion to test for a small lighting and power station near New York its entire electric meter system. Current was sold by the company in question both by meter and by contract. The sales had originally been on the contract basis only, but in 1891 a small investment in T.-H. meters was made, with results that seemed to justify an exclusive meter basis. From that time until 1897, electric meters of various makes, principally the old T.-H. and its successor, the General Electric meter, were gradually installed.

The complaints concerning bills were rather more numerous than is customary. A large number of these were traced to other causes, such as leaky transformers, old lamps, etc., but when these were excluded, there seemed still to be an unusually large percentage of complaints, the cause for which was assigned to the meters.

Such rough tests as had been made had shown almost invariably that the meters were slow rather than fast. It was finally decided to make a series of tests, changing all meters that it was practicable to remove, and ascertaining the error of every meter in service. To do this was not altogether practicable, as cases were found where for various reasons it was impossible to remove the meter for a test, and all tests made with the meter in service were excluded. What was done was to collect all available meters in the station. The tests were made at the lines. Thus the meters for these most important consumers were the ones concerning which data was obtained.

The accompanying figure shows the plan of the lamp bank and instruments. It was found convenient. By means of four switches shown, the energy on either side of the meter could be read on the wattmeter, and the power required to run the meter obtained. The rheostat R was used, when necessary to adjust the voltage. The lamps were so arranged that one, five, ten, twenty-five or fifty could be thrown in or out of circuit by the switches. Any intermediate number could be connected by unscrewing a few lamps from their sockets.

Readings of the wattmeter were taken at intervals of five seconds or oftener, while the revolutions of the dial were being counted. The meter was always allowed to run for a short time before any readings were taken, and the number of revolutions counted was usually five times the number of lamps in circuit. After testing from minimum to maximum load, the test at minimum load was repeated, and if any marked difference was noted between the two tests, the entire series of tests on that particular meter was repeated.

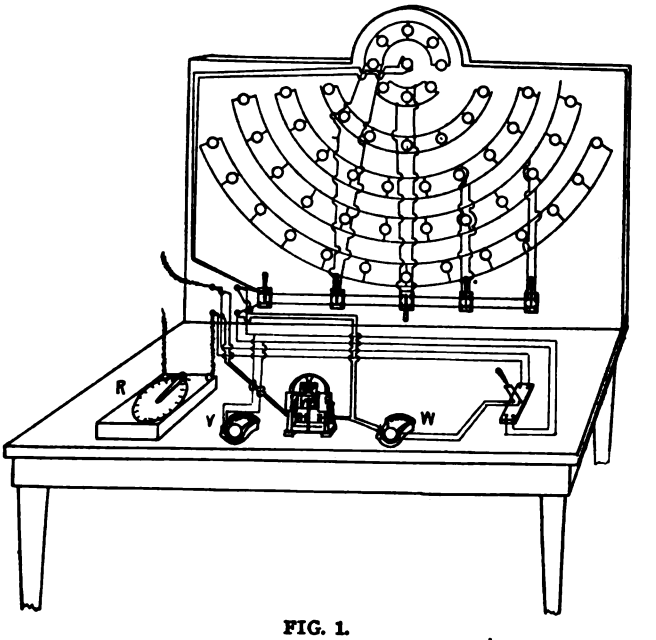


FIG. 1.

Each meter was subjected to at least two tests. One was made (where possible) with the meter in the exact condition in which it was brought into the station. After several experimental adjustments, a final test was made, to obtain the degree of accuracy of the corrected meter. In many cases, tests were made intermediate between these two. Interesting results were obtained from tests made before adjusting, but after cleaning. The number of such tests was not sufficient to give any very reliable data, however.

Upon examining the meters as brought into the station, many evidences of misuse and neglect were noted. Seals had been broken, unmistakable evidences of tampering were found in one case, reducing the speed 50 per cent. from the normal. Meters were found which failed to start on full load; when started, some ran steadily, even on minimum loads, others stopped short, and some ran in an irregular way, the rate being at no time, however, fast; except in four examples, where the meter ran on no load.

Jewel screws were discovered tightly jammed, brushes too dirty to give proper contact, cobwebs spun around the arma-

Digitized by Google

tures and fields; and these various cases were by no means rare. Several burn-outs were noted, due to overloading. The power required to run the meters (as determined by measuring the power for a single load on each side of the meter) was excessive, averaging in eleven tests made 18.3 watts. The condition of the entire system was from both a mechanical and a commercial standpoint, thoroughly bad. This was largely due to

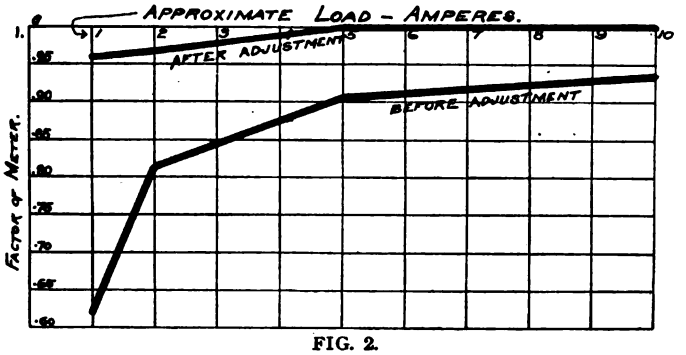


FIG. 2.

the fact that the meters had not been properly cared for, or protected from dishonest and clever consumers.

The voltage during the tests was kept at 54 or 108, which was the average supply voltage. Any variation from the rated voltage of the meter tended to make it slow, though for small variations this was not of great consequence. In one case, a 100-volt meter was found connected to a 50-volt house circuit, with the result that the consumer was getting a mechanical discount of about 30 per cent. on his bills.

DIAGRAM NO. 1. (See Fig. 2.)

Errors of 50-volt 10-ampere Thomson Recording Wattmeters, Averaged from 80 Tests.

Before Adjustment.		After Adjustment.	
Load, Amperes.	Factor.	Load, Amperes.	Factor.
1	.621	1	.961
2	.817	2	.969
5	.908	5	1.000
10	.937	10	1.000
Average, by curve	.908	Average, by curve	1.000
Average, calculated*	.898	Average, calculated*	.994

*As explained above.

DIAGRAM NO. 2. (See Fig. 3.)

Errors of 50-volt 25-ampere Thomson Recording Wattmeters, Averaged from 26 Tests.

Before Adjustment.		After Adjustment.	
Load, Amperes.	Factor.	Load, Amperes.	Factor.
2	.890	2	.970
5	.925	5	1.000
10	.920	10	1.022
15	.917	15	1.018
20	.897	20	1.015
25	.880	25	1.016
Average, by curve	.919	Average, by curve	1.020
Average, calculated*	.900	Average, calculated*	1.014

*As explained above.

The meters tested ranged in capacity from 5 to 300 amperes, and were rated at from 50 to 110 volts. Each meter was tested as closely as possible at its rated voltage, this being obtained in some cases by connecting pairs of lamps in series, and by the

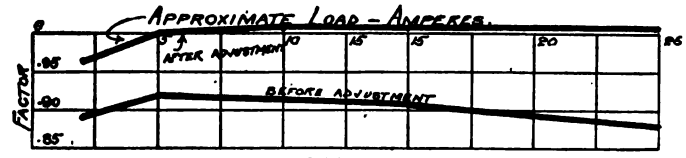


FIG. 3.

rheostat, the line voltage being about 58. As the limit of capacity of the lamp bank used was about 50 amperes at 50 volts, a reasonably large load for the larger sizes of meters was obtained by connecting several fans in circuit.

The indicating wattmeter used was a General Electric standard station instrument.

Two hundred and seventy-seven tests were made in all. The above curves show the performance of the 10-ampere 50-volt and the 25-ampere 50-volt meters.

After having obtained such curves for all the meters, the question arose as to what might be called the "average error of a meter." Evidently this is not always the arithmetical average of the errors at the several loads for which the meters are tested. If a meter operates half the time on full load and half the time on one lamp, the errors being say 10 per cent. for one lamp and 1 per cent. for full load, the error in registering will not be 5½ per cent., but will be more nearly that for the full load, as the energy measured with the full load error of the instrument in play is much greater than the energy measured during the burning of one lamp. To make the effective error 5½ per cent., it would be necessary to operate at a load of one light a much longer time, the times being inversely proportionate to the loads on the meter.

The true average error depends upon the ratio of the average load carried by the meter to its full load. By examining the record of sales for a sufficient period back it was found that the average operative load on the meters tested, for all seasons, was not far from half the rated load. Accordingly the "average results" were calculated on this basis by the following rule:

Multiply the error for each load by the number of lamps composing that load; divide the sum of these products by the sum of the separate loads.

This gave the effective average error, or that which was the ultimate outcome of the meter inaccuracies when transferred to the company's ledger.

The following results were found:

No. of meters tested.	Size of meter Volts	Amperes	Average error % Slow	Average error after adjustment; in %
6	50	50	15.4	.3 slow.
6	100	50	12.3	correct.
1	150	50	27.6	correct.
2	300	50	32.0	correct.
3	5	100	11.2	1.3 fast.
2	10	100	8.4	1.0 slow.
3	25	110	11.6	1.7 slow.
1	50	100	....	correct.
2	50	110	....	correct.
1	15	100	11.0	.....

Average error of all adjusted meters .22 per cent. slow.

This was certainly a very poor showing. The example of a 300-light meter over 30 per cent. slow shows what neglect and ignorance may do. No excessively bad values were admitted into this table. Meters which persisted in not running or in stopping, or in indulging in any other idiosyncrasies such as are peculiar to their class were consigned to the repair shop without further attention. The results represent the actual condition of the company's working meter system, and it is to be feared, the condition of a great many companies of its kind. The odium of such a condition is not to be placed wholly on the meters, but principally upon the unintelligent care given them.

As a result of the tests, the following recommendations were adopted. Another season will prove their value, and will show also whether the ordinary meter can be relied upon to retain its accuracy:

1. All meters should be tested and, if necessary, adjusted, when purchased. One meter was found to have an incorrect constant printed on its dial; an error which the ledger proved to have cost the company about $250.

2. Every meter in service should be securely sealed and kept so.

3. A test or at least a short trial of the speed on several loads should be made when each meter is installed.

4. More attention should be paid to fusing the meters down to a safe limit; 20 out of 300 is too large a percentage of burnt meters in active service.

5. Periodical cleaning of the commutators and brushes by the indexer or wireman should be insisted upon. A dust-proof meter is a desideratum.

6. Every meter should be removed and tested at least once a year.

Such suggestions as the above will seem trite and commonplace to the manager of the modern station, with its well-planned economies and thoroughly organized testing department; but in view of the results obtained in the above tests it is

Digitized by Google

fair to assume that these are the matters that are being disregarded, with a certainty of large losses by the majority of small and struggling electric companies.

Electricity in Baltimore.—Notes from the Field.

BY C. B. FAIRCHILD.

ELECTRIC LIGHTING PLANTS.

THREE companies control the electric lighting interests of Baltimore, and for some time there has been a lively rate war, and in addition to this rate war all the companies, as well as the street railway companies, have been engaged in defending their interests in the local council against the strong efforts which have been made to force all the electrical companies to put their wires underground, and into subways built and controlled by the municipality. Fortunately for the companies there has come a deadlock between the two boards of the city government, so that the matter will probably rest for a time. Neither the lighting nor the railway companies object seriously to putting their wires underground, but they claim the privilege of locating and constructing their own subways; this is especially the case with street railway companies, for otherwise they would be required to put their wires into subways not on the line of their tracks, and in many cases into too close proximity to the high-tension currents of the lighting plants. The outcome of the movement will be watched with interest, for if it carries for municipal ownership it will doubtless suggest similar action on the part of authorities of other cities.

THE BRUSH ELECTRIC COMPANY.

This company was the first to install an electric lighting system in this city, having begun its operations in 1881. It still maintains the precedence in output over all the other competitors, as its plant is equipped with engines and generators of more modern design, due, no doubt, to a fire, which, in 1893, destroyed the old station and all the apparatus.

The control of the company is under a board, of which George Westinghouse, Jr., is president, G. H. Blaxter, of Pittsburg, is manager, and E. F. Baker, local superintendent. The Brush series arc system of street illumination is employed, and the latest Brush-Adams lamp is supplied to new customers. The present city contracts amount to 791 lamps, and there are 1,589 commercial lights. The latest five-year contracts are for city lights 35 cents for all-night service, there being no moonlight schedule, and for the commercial lights the rate is 20 cents for a half night and 35 cents for all-night service. The old prices, before the rate war, were 30 and 50 cents. The constant current direct current arc light capacity of the station is 1,800 lights, while the constant potential A. C. arc light capacity is about 1,100 lights.

The present incandescent output is 38,000 16 c. p. lights. About 600 h. p. is furnished for operating small motors, for running elevators, pumps, etc., from a 220-volt system.

The station is located on East Monument street, and is a substantial fireproof building. The engine room is 130 feet square, and the floor space is 30 feet to the steel truss which supports the roof, there being no posts. The roof construction was put up by the Berlin Iron Bridge Company, and the metallic sheeting is lined by a non-condensing material supplied by the same company. The truss construction is of sufficient strength to support a load of 20,000 pounds at any point, making a safe anchorage for the hoists, by means of which the machinery is put in place. The floor is of cement. There are four subways, cement lined. The boiler room is 82x125 feet, with steel truss roof, and a steel structure over one-half for supporting coal bunkers, which are of metal, and have a capacity of 1,500 tons. The feed water heaters are also on this elevated structure, leaving large space in the boiler room proper.

The fuel is Cumberland "run of mine" coal and is delivered on cars, which run directly into the fire room and dump the coal into bins beneath the track, from which it is elevated to the fire floor, or to the storage bins, as the case may be. At present a supply of 700 tons is stored in the fire room, the automatic coaling device not yet being in operation.

The steam is generated in six 500 h. p. vertical water tube boilers of the Climax type, manufactured by the Clonbrock Steam Boiler Company, of Brooklyn, N. Y. The boiler shells are about 15 feet in diameter and 35 feet in height, and each has four fire doors; the average steam pressure is 160 pounds. There are two stacks, one of brick and one of riveted steel plates; the latter is 175 feet in height, and has no guy wires, being built funnel shape at the base and brick lined to the height of 80 feet. The auxiliary equipment consists of Knowles pumps and Berryman heaters.

The chief interest of the station, however, centres in the engine room, and about the large units employed for generating the current for the incandescent service, and in a $20,000 switchboard.

There are three incandescent direct coupled units, with a fourth being installed, each of which consists of a 1,000 h. p. Westinghouse steeple compound engine running at 205 revolutions, and a Westinghouse constant potential alternating current dynamo, with a rating of 750 k. w., and which is run under a tension of 2,800 volts. These generators are virtually double machines, there being two rings of fields having 36 poles and two armatures mounted on the same shaft to one side of the fly wheel, one being shifted ahead to the quarter phase position. The peripheral speed of the armatures is about a mile a minute.

Each half of the machine is run independent of the other, and the leads from the armature coils are led out through the hollow shaft, and connected to a four-ring collector, which is at the end of the shaft, overhanging the outside bearing, like an overhanging pulley, the rings being about 20 inches in diameter. The leads from the armature are connected to the alternate rings, thus relieving the strain that would naturally come on the insulation. From the collector brushes, which are set quartering to each other, the leads are carried to a fuse box on the machine, then into the subway and out to the switchboards. The conductors, from each armature, consist of Standard underground lead-covered cables, and beside them are the (field) wires, consisting of Standard underground duplex cables, which, after passing through the field switch, pass to the switchboard, on the same brackets as the others. The fields are excited from a 220-volt machine, driven by an independent engine. These generators are designed for a two-phase relation, but are not so run at present. It is interesting to note, in this connection, that these engines and generators were part of the Westinghouse World's Fair exhibit at Chicago. In the opinion of the superintendent, a saving of at least $300 per week is made in wages in favor of large units over those of small capacity for the same service. And again, the machines, all being overdesigned, as compared with the engine power, they cannot be injured by an overload. This insures light repairs, and in the case of the present machines only one field and one armature coil has been lost in the four years' service.

DIRECT CURRENT.

The power for this department is generated by six Westinghouse compound engines of 300 h. p. each and two 125 h. p. engines of the same type for running the exciters. The engines are located in irregular groups about the room, and in some cases each engine drives six generators by means of tandem belts, three from each flywheel. The generators consist of two direct coupled 75 k. w. machines and one 280 k. w. belted machine, both of which are of the Westinghouse type, and generate the current for exciting the fields of the large alternators and such other machines as require it. The arc light machines consist of 18 old type Brush machines, all of 60-light capacity. There are also three 80-light and one 125-light Brush machines, five 75-light Westinghouse, the latter of which are excited from the 220-volt exciters, as noted above. The old Brush machines have been changed to self-oilers since they were first installed. All the wires from the arc machines pass into the subways and from this to the arc switchboard, which is on the main floor, but at some distance from the main alternating current switchboard. The arc board is made of brown polished marble, trimmed with brass, and with sufficient plugs to accommodate 26 machine terminals and as many more circuits. The plugged receptacles are of an improved type, making four surface contacts on the plug.

MAIN SWITCHBOARD.

This is located on the street side of the main floor, and is of polished white marble, 20 feet in height, and built in two steps, or rather the upper half is set back, making a gallery in front. The lower section consists of 16 panels and the upper of 20 panels. The instruments are covered with frameless plate glass cases, which, together with the polished brass and trimmings, give to the board a very artistic appearance. The lower section

Digitized by Google

is divided at the middle, and that on the right contains the instruments for the constant potential direct current machines and their feeder panels, as well as the dynamo panels. The left side is exclusively for the constant potential alternating current dynamo feeders. The upper gallery is entirely occupied by alternating current feeder panels. Each panel is numbered to correspond with the feeder which it controls, and represents a feeder or reserve panel, and has the following instruments, beginning at the top: Three Wurts non-arcing lightning arresters, in series (this being required because of the high voltage of the machines), a converter and compensator, a pilot lamp, a voltmeter and ammeter, two plug sections, a changing switch (double throw), two more plug sections, a Stillwell regulator and two fuse blocks.

The plugs on each panel are so arranged as to make it impossible to so connect them as to short circuit the machines. This is accomplished by having the holes of the positive and negative connections of different sizes and the plugs so designed that they will only fit into their appropriate holes. The voltmeters are so designed by a peculiar method of winding as to read the voltage at the centre of distribution of each feeder. This is done in order to compensate for line losses, giving a constant potential to each consumer. As an auxiliary equipment, Stillwell regulators or converters are provided, which are designed to raise or lower the voltage 10 per cent., according to the requirements, a switch being provided for reversing the current in the primary coils.

There are many other interesting features connected with the instruments and the wiring of the switchboard, but it will require too much space to detail them in this connection. The maze of wires is so systematically arranged and numbered that although at first they seem bewildering, they are really very simple, and the board is readily manipulated by one expert attendant and a boy helper. All the cables, after leaving the switchboard, go again to the subway and pass under the sidewalks in front of the station, where they are led up the side of two large poles and out to the distributing arms, from which they branch out to the various circuits on their mission of bringing electric energy for lighting the streets, stores and houses, and for giving heat or power, according to the demand.

THE EDISON ELECTRIC ILLUMINATING COMPANY.

This is one of the early companies to undertake electric lighting in Baltimore, or, rather, it is a successor of one of the pioneer companies, which has been known under the successive names of the International Electric Telegraph and Power Company, the Fort Wayne Company and the Maryland Electric Company, the change of name coming with the change of ownership. The affairs of the company are now in the hands of Boston parties, Mr. A. A. Gassir being president and D. P. Robinson, local general manager. The plant is located on Pratt street, near Penn, and, like many other of the early stations, has been added to from time to time as business has demanded, and according to the peculiar ideas of the various managers, and now presents a remarkable combination of engines and generators, there being 13 of the former and a bewildering number and types of the latter.

The building is of brick and iron, and the engine room is divided into two parts, known as the old and the new. The former is 180x60 feet and 19 feet to the truss plates. The machines are crowded very closely together. On one side of the old engine room is a long countershaft operated at either end by a 750 h. p. Ball cross compound engine, and from this shaft, by means of a belt, are driven 11 80-light Wood machines, each pulley being provided with a friction clutch, by means of which it may be thrown in or out of action. On a line with the main shaft is a third engine of 200 h. p. of the Russell type, which drives, by means of a short countershaft, four 80-light machines and two old-type T. H. generators. The opposite side of the room is occupied by six engines, placed very close together, of various makes and designs, including a Russell, Ball, Ideal, Buckeye and Harrisburg, and both single and of cross and tandem compound types, and rated from 150 to 300 h. p. The first, or No. 4 engine, is belted to three 80-light Wood machines, while each of the others drives a single multipolar generator for incandescent lighting. Some of these are of the Slattery and others of the General Electric type, having a capacity from 1,500 to 3,000 lights.

In the new engine room No. 10 engine occupies the end of the floor, and is a tandem compound Porter Allen machine of 550 h. p., and runs at 200 revolutions per minute. This drives from two fly-wheels one large M. P. 6,000-light generator of General Electric manufacture and a 260-light constant current machine. The remaining three engines are of the Ball type, from 250 to 300 h. p., and drive several 80-light Wood machines supplying 225 lights, together with two General Electric M. P. generators for power purposes, the latter of which runs at a tension of 250 volts. The arc light circuits supply 4,160 lights, of which 675 are for the city service, the balance on commercial circuits. One daylight circuit provides for lighting the post-office and one or two other buildings.

Two types of arc lighting are employed, some of the Adams-Bagnall, others of the General Electric type. Many of the latter are of the enclosed or double globe type, and are run two in series, but are so connected that either one can be cut out without interfering with the other. A lamp repairing department is located on a gallery overlooking the large engine room, where all lamps are tested and necessary repairs made. The exhaust pipes of the engines and the leads from the generators occupy subways under the floor; the latter come up to the switchboards, of which there are two, one on the gallery in the partition between the two rooms, and the other along the front of the building. These are of marble and are equipped with General Electric instruments. The wires go from these up through the skylight out over suitable racks, there being 26 circuits.

Thirteen boilers furnish the steam, eleven of which are of the Campbell & Zell water tube safety type, and two are of the Babcock & Wilcox make, having an aggregate of 400 h. p., and are so coupled that any desired combination of steam pipes can be obtained. Two batteries of each type of boilers are provided with stokers of the Acme type; the others are fired by hand. The George's Creek coal is delivered in carts. There are four smokestacks, three 88 feet in height and one of 110 feet. There is the usual auxiliary equipment of feed water heaters of the National Excelsior type. For cleaning the boiler tubes the machine known as the Union Boiler Tube Cleaner is employed, and which has a capacity for cleaning 20 or more tubes a day. This is a rotary scraper, attached to an adjustable rod, which is moved in and out through the tube, and is driven by an endless rope from a pulley actuated by a small steam engine.

This station is neither to be criticised nor imitated. It is of value chiefly to show how electric lighting stations should not be built, and yet it is operated with a considerable degree of economy. It is soon to be superseded, however, by a new plant with modern equipment. The site for this has already been secured and plans and specifications have been prepared.

MISCELLANEOUS

Transformer Economy.[1]

BY PROF. W. E. GOLDSBOROUGH.

A GREAT deal has been said and written about the static transformer of alternating currents, and yet we are only just beginning to understand this much discussed piece of apparatus. The manufacturers have made it and experimented with it, the theorists have experimented with it and disputed over it, the underwriters have disputed over it and endured it, and the central station men have endured it and made use of it to the great good and comfort of the public. No other piece of apparatus in the field of electrical engineering has been lauded higher or been the subject of greater abuse, and to all it has served a purpose.

To-day the transformer occupies a higher position than ever before, and it grows in importance as each new development in the field of applied electricity points out a new department of usefulness for it.

With a view to investigating the present status of the transformer and the ability of transformer manufacturers to meet

[1]Abstract of a paper read before the N. E. L. A., Chicago, June, 1898.

Digitized by Google

in all cases the exacting specifications which they have laid down for themselves, I have had a number of transformers of recent design tested in the Purdue laboratories within the last year.

A 2.5 kilowatt transformer was submitted for test that was guaranteed to conform to or improve upon the following specifications: Core loss 48 watts, regulation 2.1 per cent., and full load efficiency 96.1 per cent. The test of this transformer gave, core loss 42.19 watts, regulation 1.9 per cent., full load efficiency 96.2 per cent.

The showing made by this transformer is good. The core loss is 5.81 watts less than the stipulated value, and the efficiencies are in excess of the stipulated values. In this case the manufacturers more than substantiated their guarantee, and supplied a transformer that is a greater revenue producer than the specifications call for. If the core iron of this transformer can be relied upon as not materially increasing in its hysteretic loss with age, it is an easy matter to figure the money value of the excess economy that the transformer develops.

Suppose, for instance, a contract should be made for 40 of these transformers at $30 each to meet an increase in a station load of 100 kilowatts. On an all-day schedule these transformers would probably carry a commercial load equivalent to full load working for five hours. This assumption may seem to represent a better condition of service than is usually met with in practice, but it is an assumption that is fair to the manufacturer in considering the all-day efficiency. The transformers would therefore be working under no load for 6,935 hours and under full load for 1,825 hours per year, and under the conditions of the test would save 1,794 kilowatt hours to the station. If we figure the cost of producing this power at 2 cents per kilowatt hour, the saving per year would be $35.88 for the forty transformers, or practically 3 per cent. on the amount invested in the transformers. If this power were sold for 6 cents per kilowatt hour it would represent a net gain to the purchaser of 1,794 x.06=$107.64 per year more than he had any right to expect under the contract specifications. Another similar test was cited which gave about the same results as the first one subjected to a test.

Suppose we estimate the economy of transformers of this type just as we did those of the type previously considered. The 40 transformers, working on the same schedule, would waste 4,014 kilowatt hours more power than they should under the specifications advertised. At 2 cents per kilowatt hour the total money loss would be $80 per year, or over 6.5 per cent. of the cost price of $1,200.

But these examples do not cover the ground. I will cite two others. In the case of a 15 kilowatt oil insulated transformer, guaranteed to develop a quarter load efficiency of 96 per cent., a full load efficiency of 97.4 per cent. and to have a regulation of 1.77 per cent., the test showed a quarter load efficiency of 94.5 per cent., a full load efficiency of 96.1 per cent., and a regulation of 1.6 per cent. The core loss of this transformer, which operates at 60 cycles, is 186.6 watts, and the specifications under which it was built require that the core loss should be about 150 watts.

It would take seven of these to give an output of 100 kilowatts—and they would cost not less than $115 each. The seven transformers in this case would waste 3,855 kilowatt hours in a year, which represents a financial loss of $77 in one year, over and above the loss to be expected. This approximates 10 per cent. of the original cost of the transformers and is an item that cannot be neglected. If, on the other hand, this waste power could be sold at 6 cents per kilowatt hour, it would represent a part of the just return on the investment contemplated when the transformers were purchased, and would mean $221 to the company.

I do not claim that the figures which I present to you cover all the items of expense that enter into the installation of 100 kilowatts—in transformers. They do not, but they do represent a phase of the question that deserves more than passing attention at a time when competition is becoming sharper and sharper.

In what I have so far said I have not touched upon the matter of the ageing of the transformer core-iron. In cases where it is appreciable it only serves to aggravate the conditions, and make the percentage loss greater. In the same way the cost of production and the selling price of the power both enter as important factors, as well as the cost of the transformers. All of these assumptions I have placed low and they should be regarded rather as pertinent examples of the conditions that exist in large plants. The small plants will be affected by influences of this character to a much greater extent.

I do not wish to tire you with figures, but as I believe you will be interested in these comparisons of guaranteed and actual efficiencies, I wish to call your attention to one more case before leaving this matter. Not long ago a manufacturing company requested permission to send a 1 kilowatt transformer to the university laboratories for a special test, as the transformer was of a new type and highly efficient. There was no direct guarantee in this case, but the impression was given that the transformer would develop an efficiency equal to, if not exceeding, the efficiency of any other transformer of like capacity on the market. The results of our tests indicated a core loss in a 1 k. w. transformer of 178 watts, a full load efficiency of 83.6, a quarter load efficiency of 62.4 and an all-day efficiency of only 54.5 per cent.

As regards the ageing of the modern transformer irons, I hold rather a conservative opinion at the present time. A great deal has undoubtedly been accomplished within the last few years in the way of improvement in this respect and the modern transformers that are supplied to us for testing show a wonderful gain in efficiency, due both to the lower initial core losses and to the diminished per cent. of increase of these core losses with the ageing of the iron.

The general opinion seems to prevail at present to the effect that ageing is due directly to the reversal of the direction of the flow of the magnetic flux in, rather than to long continued heating of, the iron forming the cores of transformers, and this opinion is also expressed in much of the printed matter that has come into my hands.

The fact seems to be well established that non-ageing transformer iron is a commercial possibility, but the fact remains to be demonstrated practically that material of the necessary quality can be obtained in sufficiently large quantities to supply the demands that are being made upon the manufactories.

Failure in this regard is not the fault of the builders of the transformers and I have reason to know that there are cases in which disquiet prevails in the minds of managers as to whether or not they are getting what they are paying for. I know that the general claim is made that iron with an "inappreciable ageing effect" is used, and I do not wish to go on record as claiming that it is not used, but what I do wish to point out is that there are transformers being placed on the market to-day that do not contain non-ageing iron. From a large transformer company I have received notice that "at the present time we have not non-ageing iron which will fulfill our specifications of core loss; that which we have on hand will give a core loss of from 20 per cent. to 25 per cent. greater than the amount stated in our specifications." At the present time, therefore, it is needful to make just as careful tests for ageing as for efficiency or for insulation, in spite of the fact that the former take a longer time and are therefore relatively more expensive to make.

During the last three months six transformers of different types have been subjected to more carefully conducted ageing tests in our laboratories. The completed report on these tests has come to me within the last few days and I can give you a resumé of the results.

The core losses of transformers A and B were high to begin with, the first being 72 watts and the latter 83 watts. The per cent. increase in the core loss of these two transformers does not, however, seem to be as great as the per cent. increase in the core losses of transformers C and D that are of more recent manufacture, and that showed initial core losses of 31.5 and 37 watts respectively.

Transformers B and D are of 1.5 kilowatt capacity and transformers A and C of 2.5 kilowatt capacity. An increase of from 5 to 10 per cent. is shown in all the transformers.

To get an idea of what this means suppose we consider the effect upon the economy of the 2.5 kilowatt transformers, considered in the second case discussed above of a 10 per cent. increase in the core loss. It will add $1.11 per year to the cost of operating each transformer at 2 cents per kilowatt hour, or $44.4 for the total number.

This represents an additional gain of 3.7 per cent. per year on the investment in three months, or a possible percentage loss on the investment of 14.8 per cent., after the first year, on the supposition of a uniform increase in the core loss.

Digitized by Google

These figures are not startling in any way; they are too small for that, but they are matters of fact to be taken into consideration when making investments. The opinions that I am voicing regarding the ageing of modern transformer irons are conservative, as I believe the transformers built to-day will show a marked improvement upon the performance of transformers built even as late as one year ago. As far as the ageing tests that we have made go to throw light upon the subject, I am inclined to believe that the ageing problem has as yet not been solved, as none of the transformers tested have met the requirements of the specifications under which they were submitted, and some have fallen very far short of it. All of the transformers tested were new except transformer A, which at the time these tests began had a core loss already increased to 13 per cent. above its initial value. Transformer A was built about two years ago.

The ageing of transformer iron does not increase at a constant rate with the time. The rate of increase diminishes as the service continues, but the increase may go on indefinitely. Until the use of non-ageing iron becomes more generally possible than at present, it is probable that it will pay to replace the majority of the transformers placed on the market by new ones every few years.

The correct insulation of transformers is another important point that should be considered by the central station manager. Like many of the problems with which we have to deal in the effort to make the transformer a commercial success, this one seems to be subject to a wide variety of opinion. The oil insulation of transformers has deservedly come into great favor, and where care is taken in the selection of the oils used and in the proper design of the transformer case, high protection is secured. Oil insulation under all circumstances does not, however, secure to the purchaser the protection which he feels he is paying for. The claims that are usually made for the superiority of oil insulation, to-wit, that it serves to preserve the insulation from oxidation, reinforces the resistance of the insulation to puncture, reinsulates punctures after the passage of the discharge and facilitates the diffusion of the energy liberated as heat in the core and the coils, can in general be readily substantiated.

My experience, however, is that these statements must be regarded as having only a relative bearing upon the subject. Under certain circumstances the insulating value of an oil will be very materially impaired. We are told that transformers will last indefinitely when insulated with oil, whereas without oil the insulation will be so deteriorated after five or ten years that the transformers should be placed, and it may therefore be a matter of surprise that the insulating qualities of the oil itself are ever seriously diminished. As a matter of fact experiment shows that the insulating properties of the oils commonly used in transformers are increased as their temperatures are raised up to about 110 degs. C., and that if allowed to cool they will not lose their augmented power of resisting a disruptive discharge. This much might be said in favor of oil insulation, in view of this two or three fold gain in insulating power, were it not for the fact that a continued heating of the oil for any considerable length of time changes the oil to such an extent that on being cooled its break-down value will be only about one-fifth of its original value. And therefore an oil insulated transformer that will stand an insulation test of 10,000 volts when new, may break down under a pressure of 2,000 volts after having been in continuous service for a considerable time. Conditions such as will produce a result of this character are not likely to occur in the case of modern transformers, as the increase in the temperature of even the poorest transformers rarely exceeds 70 degs. C. I have, however, met with cases in which excessive heating has resulted when the transformers were kept continuously in service, and I have also in mind a case in which a good modern transformer was so situated above a tin roof and in a position where it was protected from any breeze that might be stirring, that, when the sun played upon it, its temperature reached perfectly distressing values.

What I have said will serve as a hint of how not to handle a transformer, and the importance of selecting proper places for the location of transformers.

If you will look carefully into the matter you will find that not all of the burn-outs are due to faulty construction on the part of the manufacturer. It is my experience that the contractor has been in fault in a fair proportion of the cases in which the transformer and service installation have suffered.

For all commercial purposes the best oils will be found to give thoroughly satisfactory results and retain their insulating properties unimpaired so long as the maximum temperature of the oil does not exceed 60 or 70 degs. centigrade. In making a station test of a transformer, if the rise in the temperature of the windings, as measured by the increase of resistance method, does not exceed 50 degs. centigrade, after a ten hours' run at full load, the transformer may be passed as satisfactory in this respect.

In connection with oil insulation it must be remembered that its efficiency as an insulating medium is impaired by discharges in the oil. One of the foremost claims made in behalf of oil insulation is that it will flow in and fill up a rupture in the insulation of the coils. Every electric discharge that takes place through the oil, however, disintegrates and breaks up the normal structure of the oil, and causes carbon and other conducting compounds to form. These will rapidly multiply if the discharges are at all frequent, and will destroy the insulating properties of the oil.

There has been a great deal of interest expressed recently in the effort to formulate a definite set of specifications covering the construction and insulation of transformers, with the end in view of decreasing the fire hazard and supplying the necessary protection from loss of life and property to both the producer and consumer of electrical energy.

I have read a great many articles for and against the use of earthing devices, grounded shields and grounded secondaries, but I am yet to be convinced that the prominent American practice of high insulation resistance to a disruptive discharge and a plentiful use of well-grounded short air-gap lightning arresters, does not give a sufficiently good protection.

As I have already remarked, the number of modern transformers that are reported as burning out is relatively very small. By far the greater portion of the troubles arise from crosses between the high and low potential circuits, and in such cases the loss must be attributed to faulty installation and not to any imperfection in the transformer.

An oil insulated transformer for use on 2,500-volt primary circuits, or less, having a maximum temperature at full load not exceeding 65 degs. C. and designed to stand an insulation test without oil of 7,500 volts for five minutes, and a prolonged test of 10,000 volts with oil, will be in slight danger from lightning discharges if protected within a distance of 500 feet by a properly installed lightning arrester.

A transformer should also be able to stand a double primary potential test for five minutes, and the insulation test should be made between the coils and between each coil and the core.

In the discussion which followed the reading of this paper, Mr. Layman pointed out the necessity of having the central station man and the manufacturer work hand in hand in their attempt to produce an efficient transformer.

Mr. Thayer discussed the advisability of constructing transformers suitable for operating lamps at different hours in the day. He also stated that he had never lost a modern transformer by lightning.

Mr. Wurts then discussed at length the effect of lightning when it strikes a line, with special reference to the theory of surging of the static charge. He explained the modern meaning of short air-gap lightning arresters and how to measure the resistance of a lightning arrester, as follows:

Connect in shunt to the lightning arrester a variable spark gap, and then send disruptive discharges through these paths in parallel, one of them being the lightning arrester and the other being a variable spark gap. If the latter is closed the disrupted discharge will pass through the so-called gap. Gradually the disruptive discharges passing at intervals, open the spark gap until the discharge passes either through the arrester or the spark gap. You will reach a point where the discharges will divide, sometimes going one way and sometimes going the other. It is difficult to balance them. The length of the variable spark gap I consider a measure under these conditions of the resistance which that particular lightning arrester offers to the passage of disruptive discharges. In making measurements of that kind, between the lightning arrester referred to, having a spark gap and a resistance in series with that spark gap, in making a comparison between that and the Westinghouse non-arcing lightning arresters, I find the arrester with a short gap had just three times the resistance which the Westinghouse lightning arrester had, which lightning arrester had three gaps; in other words, I could place three

Digitized by Google

of the Westinghouse lightning arresters in series and that series in shunt, and a single short-gap lightning arrester, and the discharges would sometimes pass one way and sometimes the other, verifying the test which I made in placing a single variable spark-gap in shunt with the short gap.

Mr. Wagner then gave some valuable data on the all-day efficiency of transformers and the placing of the cost of the transformer load as regards the central station. He stated in answer to Mr. Davis that the renewal of transformers depends on the condition of the line and the method of protection of the line, there being no reliable basis for estimating the life of transformers. The depreciation of a modern transformer would not be greater than 10 per cent.

Prof. Goldsborough, in answer to Mr. Walbank, gave additional information on the relative values of oil and air insulation and the ageing of transformers, stating that at present the age loss for a year will not be over 10 per cent.

Electricity on Board the Hospital Ship Relief.

THE Relief, the Government hospital ship, which was fitted out for service in Cuban waters, left the pier at East Ninth street, New York, last Saturday. The ship, which was bought a few weeks ago by the United States Government, was formerly a Sound steamer and was built three years ago. She is about 325 feet long and has now been transformed into the most perfect and spacious hospital ship which has ever gone into service. The hull of the ship is painted white, as are her spars; the only exterior touches of color about her are a narrow band of green along her sides, the red lining of the ventilators and the red cross and the American flag which she flies. In her interior fittings the Relief is a model of modern sanitary hospital equipment. Four hundred patients may be accommodated between her decks, and in an emergency nearly twice that number of beds can be set up.

The electrical equipment of the ship is very complete. The generating plant consists of two 15 k. w. G. E. marine type multipolar generators direct connected to two G. E. marine type vertical engines. The current is distributed from a main switchboard, containing two sets of ammeters and voltmeters, and one ammeter for registering the current used by the searchlight. On the switchboard are mounted the necessary switches for distribution of currents and those necessary for connecting the two machines in multiple. The ship is wired for 400 incandescent lamps, the wiring all being done in moldings, special marine "red core" Habirshaw wire being used throughout. Lead-covered wires are used for the wiring on the decks and promenades, and the lamps at these places are attached to steam and watertight sockets and are protected from the elements by wire screens. Besides these lights there are numerous portable disc lamps in the staterooms and wards, to which are attached long flexible cords and plugs, so that the medical attendants or officers may have a light at any convenient location. Then there are placed around the wards several theatre reflector lamps for use during an operation. These stands are each furnished with a powerful reflector and a cluster of six incandescent lights. The lamps in all the five wards have very ornamental globes, which are in perfect harmony with the handsome gold and white decorations throughout the ship. There are also several side and headlights around the hull of the ship so as to make its presence and mission known to all at night. To further insure this, as well as its own safety, a powerful G. E. searchlight has been mounted on the bridge, said to be of ten million c. p. and having an 18-inch projector. Perhaps the most interesting feature of the installations on this ship is the important part electricity plays in its medical equipment. The operating room, which is located on the main deck, is cooled by a number of 1-12 h. p. Lundell bracket fans, of which there are 65 on the ship, and several 1-6 h. p. ceiling fans, of which there are 25. A cauterizing apparatus operated by an electric motor and electric lights with reflectors complete the electrical equipment within the operating room. Complete X-ray outfits have been installed on the main deck right outside of the operating room, as they are too large to be placed inside. One of these sets was furnished by Otis, Clapp & Son, Providence, R. I., and consists of a large static machine driven by a ½ h. p. G. E. motor and giving a 12-inch spark. The other two outfits are of the well-known Thomson inductoriums, manufactured by the G. E. Company at Harrison, N. J. The coils are 14 inches long and receive current from five storage cells of 150 a. h. capacity, furnished by the Electric Storage Battery Company, of Philadelphia. The coils give a 10-inch spark. A complete bell system is employed throughout the ship, as well as telephone apparatus, the latter manufactured by the Wilhelm Telephone Manufacturing Company, of Buffalo, N. Y. There has also been installed an automatic electric steam whistle, which can be operated from the bridge, and a 3 h. p. and a 2 h. p. Sturtevant exhaust fans on the main deck for carrying off the fumes from the engine room, as well as those from the following apparatus: A distilling plant, a carbonizing machine, which can furnish 2,000 gallons of soda water per day, a freezing plant, by which sea water can be converted into fresh ice, a disinfecting plant and a steam laundry. The entire electrical equipment was installed by Jos. Barre & Co., 25 Fulton street, New York, under the supervision of Mr. John P. Lund, assisted by Mr. T. A. Robinson and a large number of experienced wiremen.

A Statue of Franklin for Philadelphia.

IT is hard to believe that the city of Philadelphia is still without a statue of its great citizen, the statesman, author and philosopher, Benjamin Franklin, but such is the fact. We are glad to be able now to record the munificence of Mr. Justus C. Strawbridge, who is removing that reproach by presenting to Philadelphia a fine public statue of Dr. Franklin. Through his courtesy and that of Mr. John J. Boyle, the sculptor to whom the commission has been entrusted, we present herewith a picture of the statue as exhibited recently in Mr. Boyle's studio, in the clay model. The statue when finished in bronze is to be set up in front of the postoffice, an appropriate situation, in the heart of the city and worthily occupied by a memorial to one who was the first Postmaster General of the United States.

BOYLE'S STATUE OF BENJAMIN FRANKLIN FOR PHILADELPHIA, PA.

Franklin is shown seated in a Colonial chair of the period, one hand resting on its arm, while the other hand holds a scroll of manuscript; and a book, to which probably some reference has just been made, stands against the legs of the chair. For the head, Mr. Boyle has adhered closely to the outlines of the well known Houdon bust, but has thrown into the features the best expression of the large-hearted and broadly-sympathetic man whose tastes made him also one of the most distinguished scientific investigators of his time, as well as one of the clearest thinkers and writers on political and economical subjects. The figure is dressed in ordinary small clothes, over which is worn the large, loose fur-trimmed surtout made familiar by the Duplessis portrait. The statue will not be visible from the rear, being backed against the granite of the postoffice building, which should throw the bronze into high relief. The best view will be had by passers-by on Chestnut street. This monument to one of the foremost founders of the Republic is a worthy addition to the National statuary.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico, - - - - - -	per year,	$3.00
Four or more Copies in Clubs (each), - - - - - -	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies, - - - - - - - - - - - -	"	.10

[Entered as second-class matter at the New York Post Office, April 9, 1888.]

Vol. XXVI. NEW YORK, JULY 7, 1898. No. 531.

Standardization of Electrical Apparatus and Nomenclature.

WHENEVER an art reaches that state of perfection, or has expanded to such an extent, that it demands standardization of its terms and apparatus, it becomes the duty of the practitioners to formulate for their own use and convenience standard rules, regulations and definitions. The necessity for such action had been felt for some time past by the manufacturers and buyers of electrical apparatus, when the A. I. E. E. finally took the matter in hand and appointed a committee who were to formulate definitions and standards based on modern practice which would serve as a guide to American electrical engineers in the construction and nomenclature of their apparatus.

That committee, composed of distinguished men, representing every branch of electrical engineering, who have for years enjoyed the confidence of the profession, have finished their important and delicate task and have submitted for the consideration of the members of the Institute and the profession in general their preliminary report on the standardization of apparatus. This report, which was submitted at the general meeting of the Institute held at Omaha is so thorough, complete and timely in every particular that we are assured of its cordial reception by every member of our profession. It embraces not alone suggestions as to the standardization of the sizes of apparatus, but includes definitions of terms most frequently met with in plant specifications, as well as suggestions for standard methods of conducting and recording tests.

The first subject taken up by the committee for standardization and which occupies one-half of the report, is that of "efficiency." After defining this term, they suggest methods for measuring it as well as electrical and mechanical power, specifying the correct use of the terms designating the various electrical and mechanical losses. The next thing taken up under the general heading "Efficiency" is the commutating machines, including direct-current generators and motors, direct-current boosters, motor generators, dynamotors, converters and closed coil arc machines. Definitions of these machines are then given and their electrical, magnetic and mechanical losses and efficiency are fully discussed. Under the next subheading are included synchronous machines, treated similarly to the above; then come in the order given: Synchronous commutating machines, including (1) synchronous converters, i. e., converters from alternating to direct and vice versa, and (2) double-current generators, i. e., generators producing both direct and alternating currents. Rectifying machines or pulsating-current generators, including (1) open-coil arc machines, (2) constant-current rectifiers and (3) constant potential rectifiers. Stationary induction apparatus, including (1) transformers, compensators or auto-transformers, (2) potential regulators of the induction or magneto type, and (3) reaction coils. Rotary induction apparatus, comprising induction motors, induction generators, frequency changers and rotary-phase transformers. Transmission lines, the efficiency of which is fully defined and a uniform measurement of it proposed. The next subject taken up for discussion is that of rise of temperature, wherein the highest permissible temperature of apparatus under various conditions is laid down, and how and where such temperature should be measured. The subject of insulation, which is the next to receive attention, is subdivided into insulation resistance and di-electric strength, valuable data being presented for the guidance of those dealing with high potential circuits and apparatus. Following this chapter is one on regulation, which includes definitions of the term as applied to all classes of electrical machinery; and appended to this chapter is one on variation and pulsation. The concluding chapter, namely, the one on rating, is one which will be welcomed by the student and layman alike, as it affords them a means for the correct and uniform designation of all apparatus, with respect to their voltages and frequencies. Appended to the report is a recommendation of a notation which has already become fairly well standardized by continual usage.

Such is the wide scope covered by the remarkable document prepared by the Institute committee, of which Dr. Francis B. Crocker is chairman, and the following are members: Drs. Cary T. Hutchinson and A. E. Kennelly and Messrs. John W. Lieb, Jr., Charles P. Steinmetz, Lewis B. Stillwell and Elihu Thomson. It is a report which should find acceptance not only on this side of the Atlantic, but receive the sanction of our cousins on the other side. It is of an international character covering the practice of modern electrical engineers in all countries. Standardization of machinery means nothing more nor less than uniformity of practice, which is its natural consequence. It resolves itself simply into a definition of the word "standardization," as meaning uniformity of practice and apparatus. Viewing standardization in this light, no one will deny that it is as flexible as uniformity and subject to the same conditions of change of practice. Both allow improvements to go on and will be of incalculable benefits to the profession by avoiding confusion, reducing cost and preventing delays. It is the number of so-called standards in use ofttimes in one country, and not he use of one standard, subject to change as the conditions of trade or advanced thought demand it, that has caused confusion and annoyance. This we trust will be avoided in the future by the adoption of the work of the standardizing committee.

Tests With an Induction Generator.

A VERY timely and interesting paper was the one describing the tests with an induction generator, read by A. F. McKissick at the general meeting of the A. I. E. E. at Omaha. Its great value lay in the fact that it contained experimental data and curves which verified previous suggestions made by Mr. Steinmetz and thus placed the induction generator on a definite basis. While the extensive employment of the induction generator is still a matter for speculation it possesses such admirable qualities as to make it well worthy of the attention of electrical engineers. It was Mr. Steinmetz who pointed out that the induction generator must necessarily have as a load a circuit of leading current. But when the conditions are such that it can be used, the induction generator has the great advantage of the absolute absence of continuous current exciting circuits, collector rings, or any other parts requiring attention. The voltage, he continued, is generated in a stationary structure, and the revolving part is a solid structure of iron and copper bars. Furthermore, as soon as the circuit is opened or short-circuited, the power is gone and the machine is dead, so that it is a type of alternator requiring no attention whatever. Besides it can be run at different speeds and still the same frequency can be obtained from it. Comparing the induction motor curves with those of the induction generator the peculiar feature is brought out that the same machine as an induction generator gives a considerably larger output electrically than as an induction motor mechanically. All these points were carefully tested and verified by Mr. McKissick, whose curves and data will have a permanent value.

He also verified the suggestion of Mr. Kelly that the induction generator can be advantageously used as a booster, being a machine with no brushes, collector rings or commutator. The author of the paper also pointed out the advantage which could be taken of the induction motor when used for the propulsion of street cars, acting as a generator in descending grades, pumping

Digitized by Google

back energy into the line, doing away with braking to a great extent. And thus not only has the value of the induction generator been demonstrated, but also the fact again that patient experimenting tending to a definite end will always leave a lasting impression on the progress of an art.

Bell Telephones In Use.

IT is worthy of note that according to the June monthly return of the American Bell Telephone Company the number of their instruments in use has crossed the 1,000,000 mark, showing there to be not far short of a half a million Bell telephone subscribers in this country, and a gain of 85,000 subscribers since June, 1897, as the gain in instruments in that period has been 170,997. This must be admitted to be an enormous gain, the total number of instruments outstanding being 1,012,159 on June 20, as compared with 841,162 a year ago. Yet had the same annual gain been made during the past twenty years, the Bell Company would now have 1,750,000, and the pasture for the new independent companies to graze on would have been correspondingly limited. It is early to determine any average or proportion of telephones to population in the United States, but there has certainly been a much nearer approximation to it the last year or two than ever before, as the result of the great stimulus to the industry given by what is known as the "independent" movement. Some of the rates quoted by these new concerns are amazingly low, but the mortality among the enterprises launched with such apparent recklessness has not yet been high by any means. It would be interesting to have their figures of net gain in subscribers as compared with the Bell during the past year. We should estimate it as fully equal, making an increase of 150,000 telephone subscribers for the whole country for 1897. Moreover, most of these have been gathered in from relatively small communities. There is no "opposition" in New York, Brooklyn, Philadelphia, Boston, Chicago and several other large cities, where the outcry against high charges has been loudest. Signs of it have not been wanting, of course, but the lack of it is due probably to the general satisfaction of the public with the service and the difficulty or expense of putting in a new system, with underground wires, able to compete with the service already intrenched and organized.

As things are, every indication points to a more rapid telephone growth than ever, and to success in the field based rather upon merits of apparatus and service than upon patents merely, or other passing influences of that nature. The public values the telephone highly, and is coming to depend upon it, and, having acquired the telephone habit, may be trusted to increase its patronage of the system at a growing ratio.

Women Car Conductors.

IN some parts of South America it has long been the custom to employ women as conductors on the street cars. The practice has now been taken up in this country by the Chillicothe, O., Electric Railroad, Light and Power Company, from whose president, W. J. Myers, we have quite a cheery letter on the subject. He says: "We could not afford to employ men, and we could not see why women would not make as good conductors as men. We keep them on duty ten hours per day and pay them $4 per week; and they are proving themselves in every way competent and efficient. We were very particular in selecting them and had no trouble in getting good applications, and a great many more than we are able to employ. It gives us a very clean service and we think that this will be a new field for the employment of ladies." This is certainly an encouraging outlook for those who wish to see the sphere of woman's work enlarged; but we confess that to our way of thinking there are nicer employments for women than running tne fare end of the street car business. We are not familiar with the characteristics of the people of Chillicothe, but the men are probably gallant enough to do all they can to assist the women in their work, and render it as easy and light as possible. Outside of Chillicothe it might be different, for the burdens of conductorship in large cities are by no means small. It will be interesting to see how the Chillicothe experiment works out. If the Spaniards insist that we shall wipe them bodily off the face of the earth before they quit fighting, we may need more women conductors and perhaps some women "motorneers."

THE war taxes are now being imposed and their collection appears to be going along very smoothly. No one likes to be taxed, and the readiness with which the new burdens are assumed must be taken as another proof of the strength of the national feeling that is behind the Government in the war with Spain. The special one-cent telegraph and telephone taxes have been arranged for without difficulty. The telegraph companies have left it to their customers to put on the penny stamp, and while one hears some sharp words about this action, generally it is quietly acquiesced in. In New York City the local telephone company has wisely made its long proposed reduction of tolls coincide with the imposition of the tax, so that the 15-cent message is now 10 cents, and no one is a bit the worse off except the Government, and the amount that the Government loses is too small to worry about. In other parts of the country the telephone exchanges are for the present apparently leaving their rates unchanged and paying the one cent themselves.

THE Omaha meeting of the American Institute of Electrical Engineers, which was held last week, was worthy of that society. Having met in the far East in 1897, it was only fit and proper that the Institute should go West this year, even if the prospect of a good attendance was small. The programme of papers was admirable, and in solidity and real value the contributions would be hard to surpass. Attention is directed to some of the papers in this issue, and it will be gathered that the Institute, under Dr. Kennelly, promises to be more useful than ever to the profession at large.

INDEPENDENT telephony, as it is called, is still young, but it is vigorous and growing. It appears to find some difficulty in reaching the "convention" stage, but the rather slim meeting in Chicago last week is expected to be followed by a much larger one in September or October. The effort of those interested in independent telephony to square it with actual conditions and problems is seen in the various changes to the constitution which was drawn up only a year ago at Detroit and which committed the association to a programme involving no slight difficulty in its successful accomplishment.

OBITUARY

Mrs. Charles E. Newton.

A great many in the electrical field will regret to learn of the death from pneumonia of Mrs. Alice Huntington, wife of Mr. Charles E. Newton, secretary of the Jewell Belting Company, of Hartford, Conn. She was the daughter of Prof. Charles W. Huntington and an active member of the Baptist Asylum Avenue Church. She leaves three children. The sympathy of a large circle of friends is extended to the bereaved husband and family.

MARRIED

Ward—Clarke.

The "war weddings" are quite numerous and interesting. Mrs. Edith Wigham Clarke, of this city, was married at Chattanooga, Tenn., a few days ago to Major George Gray Ward, chief surgeon of the Twelfth Regiment. She is the daughter of the late Thomas M. Wigham, who was a partner in the well-known Wall street banking firm of Jacob Little & Co. She is a very popular society women, one of the organizers of the Badminton Club, and Dr. Ward is a well-known physician of this city. He is the son of Vice-President Ward, of the Commercial Cable Company, and was born in London about thirty-one years ago. The first public announcement of the engagement was made on April 1. It was intended to have the ceremony in this city after Dr. Ward's return from the front. Dr. Ward, however, insisted that the wedding take place without delay, as his regiment is one that has been ordered into active service.

Digitized by Google

TELEPHONY AND TELEGRAPHY

Practical Features of Telephone Work.—XVI.

BY A. E. DOBBS.

THE INDUCTION COIL.

THE purpose of the induction coil is to raise the battery power of the one or two cells used for the transmitter of from 1.5 to 3 volts, to a much higher pressure, in order to overcome the resistance of long lines. A small amount of current at a high pressure will do the same amount of work as a larger current at a lower pressure, exactly as a transformer does in electric lighting. For example, in long distance power transmission by alternating currents the pressure is from 10,000 to 30,000 volts. Now, no machine would be safe at this terrific pressure. Instead then of generating this high pressure the machine delivers a powerful current at a pressure not to exceed 3,000 volts, and more frequently 300 when it is changed or stepped up, by means of a transformer. This is simply a form of induction coil, wound to give the necessary voltage (pressure) for long distance transmission, and the current is transformed back again to 100 or 500 volts for lighting and power at the other end. Thus we see that the same kind of an induction coil (transformer) can be used to step the current either up or down, as may be required.

This stepping up and down always increases or decreases the quantity of current in inverse ratio to the voltage, minus, of

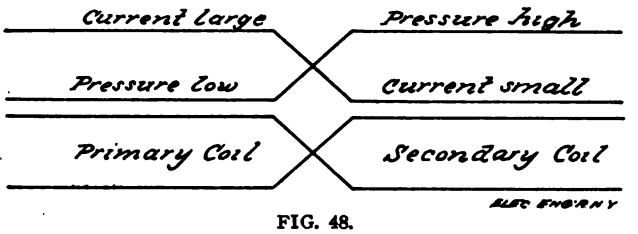


FIG. 48.

course, a small amount lost in transformation. Thus a transformer, whose ratio is 20 to 1, which is commonly used in electric lighting, may take in a current of only 10 amperes on one side, at a pressure of 2,000 volts, coming out on the other side at a pressure of only 100 volts, while the current has risen from 10 amperes to nearly 200.

All induction coils and transformers will work either way; first, to raise the pressure and decrease the current; or, second, to raise the current and decrease the pressure, as shown in Fig. 48, and it will be noticed by a comparison of the lines that the power remains the same in both cases. That is, theoretically, practically there is a loss of from 3 to 50 per cent. Telephone induction coils, wound to a proportion of 500 to 1, which is commonly used with the Blake transmitter, will raise the battery current to more than 1,000 volts, but the quantity of current has become so small and the alternations are so rapid that it cannot be felt if taken through the body; because at this ratio a current of 1 ampere in the primary circuit becomes less than .05 of an ampere in the secondary, and yet this is several times the amount used even in long distance instruments.

It may be of interest to note that in one of Dr. Wietlisbach's experiments the secondary current from a Blake transmitter over a resistance of 1,000 ohms was .0000547 ampere. Prof. Cross, with a resistance of 400 ohms and 512 vibrations per second, obtained from three different instruments, using Blake, Edison and Hunning's transmitters, currents ranging from .000072 to .000556 ampere, the windings of the coils not being given. The small amount of current used shows the extreme sensitiveness of the telephone receiver.

A PRIMARY LESSON.

Most of our readers understand something about this subject of induction coils, and yet there are some well-informed telephone men who review it occasionally. The best training in telephone work is a course of study in alternating currents, as applied to power and lighting, because these currents being larger and the alternations (reversals) less rapid, their effects and peculiarities can be studied more closely, and a great many things which puzzle the man who knows nothing but telephone work, become plain to the one who has studied the former.[1]

While the induction coil may be constructed in a variety of ways and possess any shape or size which will give the correct transformation, the most common form employed in telephone work is the one shown in Fig. 49, in which the primary is

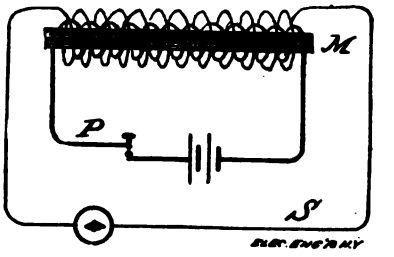
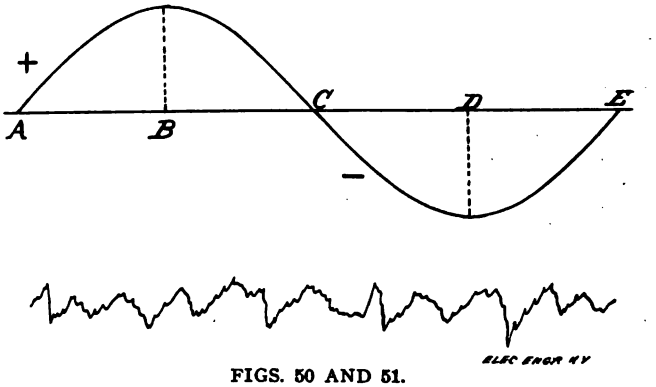


FIG. 49.

wound in a comparatively small number of turns around the iron core, and the secondary, with a larger number, wound outside. In order that the battery pressure may be increased when connected to the primary, it is necessary that the secondary winding should have a great many more turns, and in order to bring it as near to the iron core as possible the wire is a great deal smaller, usually about No. 36 or No. 40, and, of course, its resistance is much higher. Now this resistance is not a virtue, for we would prefer to do without it if we could. In order that the sound waves may not be distorted too much, the coil and iron core must not exceed a certain size, say 4 inches in length, and as the primary coil is wound on the spool with from 100 to 200 turns, and the secondary from 3,000 to 5,000 turns, it is easy to see that it must be very small to keep it within the space allotted to it. The proportions are a matter of considerable importance and in order to obtain good service they should all be as nearly alike as possible, as coils of the same size, windings and resistance will help each other out.

According to experiments made by W. H. Preece, the most successful coil for all-around work up to 50 miles, was a coil with a resistance of .5 ohm in the primary and 250 ohms in the secondary, and the best coils yet found for local business, at least in connection with the Blake transmitter, have about this proportion.

On measuring up about a dozen instruments recently, some of the latest the Bell Co. have sent out of the Blake pattern, I found the resistance of the primary coil measured through the switch to average .8 ohm (though one was found as low as .27 ohm), with the secondary coil measuring from 250 to 260 ohms,



FIGS. 50 AND 51.

and the Blake transmitter button, with a rather loose adjustment, varying from 2.29 to 4.4 ohms. These instruments were as satisfactory a lot of Blake instruments as the Bell Co. ever turned out, which led me to think they had struck about the right proportion. With the long distance, solid back instruments, however, the case was different, the resistance of the transmitter being from 12 to 30 ohms, which required, of

[1]Those who wish to follow this subject further may refer to the following books: The Alternate Current Transformer in Theory and Practice, Vol. I., by A. J. Fleming; Handbook on the Telephone, by Preece and Stubbs, and Theory of Telephonic Transmission, by Dr. V. Wietlisbach.

Digitized by Google

course, two powerful Fuller cells and a larger coil, it measuring 4½ inches long, the primary winding measuring 1.5 to 2 ohms and the secondary from 18 to 19 ohms.

Of course it must be remembered that a loose carbon contact is quite an uncertain factor, but still it comes near enough for comparisons to be made, and some of the most successful independent instruments showed similar results.

One American Electric solid back transmitter showed good results with a coil about 4½ inches long with secondary resistance of 220 ohms, while another good talker, an old style Kokomo Hunning, has a secondary of 230 ohms (long coil), and a primary circuit of 15 ohms, including the transmitter.

This high resistance of the Hunning, or any granulated carbon transmitter, makes two or more cells of battery necessary in order to give the proper magnetizing force to the primary coil. But too many turns means sluggish action in the coil, and therefore the winding in the primary should not exceed 1.5 ohms, with say a winding of perhaps 225 ohms in the secondary; but whatever coil is adopted, take that as standard, and make other coils conform to it.

If a coil is too small, we have clear articulation, but very weak sounds. If the coil is too large, we have loudness at the expense of clearness, and sound waves are so complicated in character that it is a constant source of wonder to the electrical engineer that they are transmitted at all. In currents used for lighting and power, it is the aim of the dynamo builder to so balance his coils that the resultant waves will come in the form of a sine curve (Fig. 50) in which the current starts at zero, rises to a maximum at B, falling to zero again at C, then repeating the performance in the opposite direction. Such a curve can be transmitted further with less loss, than any other; and the more a wave departs from this form the greater the distortion from resistance, self-induction, retardation, etc. An example of this can be seen in the way cable messages are received across the ocean. In crossing the ocean the dots and dashes, made on the siphon recorder, encounter so much wave distortion that they could not be distinguished, except by an operator used to these peculiarities, the difficulty increasing with the speed; for the higher the speed the greater the wave distortion. But the highest cable speed hardly means more than from 10 to 20 impulses per second, while a telephone has to take from 200 to 2,000 per second, and besides the telephone wave is not a sine curve as shown in Fig. 50, nor a series of distinct impulses as in a cable message, for if it were telephonic transmission would be an easier problem. Besides it is pretty well known that pure musical tones can be transmitted much further than articulate speech, because musical tones more nearly represent a sine curve. Articulate speech is so loaded down with overtones that the curve looks more like that shown in Fig. 51, and yet in spite of all this, every one of these is reproduced if the line is not too long.

The Evolution of the Telephone Line Signal.[1]

BY ARTHUR VAUGHN ABBOTT.

A CAREFUL observer at the first great American Exposition, the Philadelphia Centennial, might have noticed a fine wire running along a gallery in Machinery Hall, terminating at either end of the building in a small closet. Continued investigation would have disclosed a curious trumpet shaped apparatus into which the wire extended, whereby an attentive listener could, with the aid of a vivid imagination, distinguish articulated sentences delivered at the other extremity of the wire. Such was the first public exhibition of the telephone, whereby the transmission of speech by electricity became a fact, and in the quarter of a century which has since elapsed, electrical arachnids have been so industriously spinning a copper web that upwards of 600,000 miles of telephone wire now cover this continent, placing some 400,000 persons in talking relations with each other, and annually transmitting about 900,000,000 messages. But the invention of the telephone was only half the solution of the transmission problem, for the instrument itself was useless without the necessary connecting circuit. Receivers and transmitters are now much the same that they were twenty years ago, but a vast amount of skill and ingenuity has been expended upon apparatus for rapidly, effectually and economically placing subscribers in talking relations with each other, and the telephonist of to-day is essentially a "Transmission Engineer."

When telephonic communication is limited to two persons, it is simplicity itself to connect them by the requisite circuit and provide proper signals to attract attention to the reception of messages, but when the number of correspondents in a single locality is to be numbered by thousands and tens of thousands, it is physically and financially impossible to erect a line from each station to all of the others, so early telephone undertakings developed the idea of the "central office," to which lines from all subscribers in the immediate vicinity converge, equipped with the necessary paraphernalia for interconnecting at pleasure any pair of circuits. To carry out the exchange system, the first requisite is to provide each circuit with some form of apparatus whereby the person desiring to send a message may gain the attention of the central office attendant. As the early telephonists comprised many recruits from the "locksmith and bell-hanger school," to which the degree of "electrician" had recently been added, on account of a supposed familiarity with the installation of electric bells, it is not surprising that the earliest line signal was the then crude form of hotel annunciator. It consisted of a pair of bulky spools wound with cotton covered wire, over which an armature was pivoted, carrying a catch that normally retained in a vertical position a door, or shutter. Electrical excitement of the spools released the catch and allowed the shutter to fall forward, disclosing a name or number painted upon its inner surface. From the falling shutter, this piece of apparatus obtained the euphonious name of "drop," and as originally designed it was exceedingly clumsy, occupying a space of 2 inches by 3¼ inches, so but a very slight exhibition of mechanical skill sufficed to refine and compact it to a notable degree. When it was attempted, however, to set annunciators of this improved description in sufficient proximity to each other to place before a single operator such a number of lines as it was possible for one person to adequately serve, much difficulty was experienced, due to the cross-talk developed by magnetic leakage between the spools of adjacent signals.

Increased mechanical skill and electrical knowledge obviated the cross-talk difficulty by ironcladding, and in this form, known as the "tubular drop," the line signal remained in statu quo for a number of years, and is still very widely employed. But in spite of improved mechanical and electrical details the tubular drop proved itself to be anything but an efficient signal. The falling shutter frequently did not attract the notice of the operator, even though the latter were careful and attentive. Accumulation of dust, either around the trunnions supporting the armature, or under the shutter hook, prevented the shutter from falling, and if adjusted for maximum sensitiveness, the slightest earth current, or the discharge from a summer thunder shower was often sufficient to display the signals of an entire switchboard. It is necessary to manually restore the shutter every time it falls, thus necessitating a considerable expenditure of time and energy for this purpose, and so the next step was the so-called self-restoring drop.

Here great skill has been displayed in mechanically designing and constructing the signal. The head of the drop is provided with a double shutter, one thick and heavy of iron, retained in its place by a lever catch connected to the rear armature; the other, a thin outer flap of aluminum that normally conceals the number painted upon the iron disk. Electrically, there are two spools. The right hand winding is designed for the calling circuit, and when excited attracts the rear armature of the drop, lifting the catch and allowing the heavy iron shutter to fall forward, thus raising the aluminum flap and disclosing the number. The other winding comprises the restoring circuit, consisting of a smaller spool which may be excited by a battery controlled by the operator in front of whom the drop is placed, the magnetism thus developed being sufficient to pull the heavy iron shutter back into its place, allowing the aluminum flap and catch to return, thus restoring the drop to its calling position. Line signals should possess five characteristics: 1. Certainty in operation. 2. Ability to immediately attract attention. 3. Positiveness in the information conveyed. 4. Compactness. 5. Automatic operation.

The attempt to simultaneously attain all of these features has given rise to hosts of devices which, for purposes of classification, may be roughly divided into three groups: 1. Electric signals. 2. Electro-mechanical signals. 3. Luminous signals.

The self-restoring drop is the best illustration of a signal of

[1]Presented at the fifteenth general meeting of the American Institute of Electrical Engineers, Omaha, June 29, 1898. Abstract.

Digitized by Google

the first class. The excitation of the tripping coil by the subscribers' ringing current exhibits the signal, while with the second circuit the operator electrically restores the signal to its normal position. A particularly successful one, reliable, compact and automatic, consists of a spool surrounded by a pivoted sheet iron armature. Normally, the armature is out of sight, but on exciting the spool the magnetization induced causes the armature to rise, displaying the number painted upon the face of the armature. From the method of operation, this signal has received the suggestive cognomen of "tip-up." Unfortunately this signal is only well adapted for use where battery currents are employed, as it is not so effective with alternating currents, and in order for the signal to remain visible the magnet must be continuously excited. In another arrangement, which is ingenious and seems to possess much merit, but has never received a wide application, the usual exciting spool is supplied with a pair of projecting pole-pieces which surround a slightly inclined tube. In this tube a silvered steel ball is placed and the tube so inclined that normally the ball rolls out of view. When the spool is excited the magnetization developed causes the ball to roll forward and to project through a plate covering the orifice of the tube, which also prevents it from being expelled and lost.

Many forms of luminous signals have been suggested, but the only one in successful operation at present is the miniature incandescent lamp which has, on the whole, proven itself of the greatest value. So far as the writer can ascertain, the idea of employing incandescent lamps for signal purposes arose with Mr. J. J. O'Connell, of the Chicago Telephone Company, who suggested in 1888 the employment of an incandescent lamp upon burglar alarm circuits in order to permit the legitimate occupant of a protected room to send to the alarm office an identification signal whereby his entrance to the premises could be made known.

In the latter part of the summer of 1890 some of the trunk lines in use in Chicago were provided with disconnect signals using miniature incandescent lamps. At the receiving office the trunk lines terminated in the ordinary cords and plugs used upon a telephone switchboard, in front of each of which an incandescent lamp was located. So long as the line was in use a relay in conjunction therewith was excited by battery current flowing over the line, and its armature drawn up. As soon as conversation was completed the operator at the originating office withdrew the plug from the trunk line jack at that office, thus opening the battery circuit and causing the relay to be de-energized; the release of the relay armature completed a local battery circuit, illuminating the incandescent lamp. The operator at the receiving office, noticing the illumination of the lamp, was thereby informed that conversation was completed and instructed to remove the trunk line plug. As the local lamp circuit was carried through the operator's listening key, the placing of this key in the testing position extinguished the lamp. A very short experience served to demonstrate the superiority of incandescent lamps over any other form of signal, for the illuminated lamp was at once so positive and distinct as to instantly attract the attention of the operator, thus markedly accelerating switchboard work. As a result of this experience, most of the trunk lines in the main office of the Chicago Telephone Company were rapidly supplied with lamp signals.

In the spring of 1893 it was proposed to re-equip a large multiple board in the Chicago exchange with self-restoring drops, but the expense and difficulty of this change caused the management to hesitate, and at this time the writer suggested the employment of incandescent lamps as subscribers' line signals on the ground of greater economy in space, and in installation, as well as improved signal efficiency. More conservative telephonists doubted the wisdom of such a recommendation, fearing that the numerous relay contacts would be a perpetual source of trouble, and no further steps were taken with this project. In the winter of 1894 a new type of switchboard known as the "express board" was introduced. As this board was designed to meet the wants of metallic circuit subscribers, particularly those whose telephonic business was large, it was decided to provide incandescent lamp line signals. The circuit of this board was so arranged that on the removal of the subscriber's receiver from its suspending hook, the movement of the hook closed the circuit and allowed battery current to flow through the line. This current actuated a relay at the exchange, in the local of which the signal was placed, situated behind a ground glass shade upon which the number of the subscriber was painted. The illumination of this disk displayed a very distinct and conspicuous signal that immediately attracted the operator's attention. Notwithstanding some apprehension as to the possibility of trouble with relay contacts, the service given by the lamp signal was, on the whole, so satisfactory as immediately to concentrate telephonic attention upon the use of lamps, and within the four years that have since elapsed, the superiority of the incandescent lamp for this purpose has been so fully demonstrated that nearly all of the large switchboards which are at present being constructed are completely supplied with signals of this description.

As the service to which the incandescent lamp when used as a signal is subjected is peculiar, the employment of lamps upon telephone switchboards has afforded lamp manufacturers a new problem. In the early experiments ordinary miniature lamps of low voltage were employed. As these lamps were bulky and consumed a large amount of current, the first attempts at improvement were directed to obtaining a smaller and more economical lamp. The early lamps were designed entirely to fit a socket with a screw thread. The socket consisted of a brass tube, in the bottom of which a screw base was placed matching the thread upon the lamp. A cap carrying a ground glass shade covered the front end of the tube, while from the rear two conductors extended, one fastened to the thread of the socket, thus connecting with one of the lamp leading-in wires, while the other was arranged to make contact with the other leading-in wire in the centre of the lamp base. This conductor was supplied with a spiral spring, the pressure of which it was expected would lock the lamp in its place and constantly maintain good electrical contact. This expectation was not fulfilled, for one of the greatest troubles encountered has been the loosening of the lamp in its socket, due to the almost inappreciable jarring to which all buildings are subjected. Lamps in sockets of this description will gradually unscrew, opening the electrical circuit; they are then incapacitated as signals and considerable complaint will arise. Lamp sockets of this kind could be placed on wooden strips for mounting in the switchboard on one-inch centres. The present lamp occupies no greater volume than that required by a spring-jack and may be inserted into sockets composed of pairs of springs arranged on a rubber strip. Such sockets so closely resemble standard spring-jacks that they are called "lamp-jacks," for they occupy the same space, and may be secured in the switchboard in the same manner. By placing alternate strips of lamp sockets and jacks, the subscriber's line signal and answering jack may be more closely associated than has previously been possible, space economized in the switchboard and service accelerated.

The Szczepanik Telelectroscope.

EVER since the announcement of the invention of the telelectroscope, an apparatus for the transmission of scenes and pictures over a wire, by the young Polish school teacher, Szczepanik, vague and exaggerated reports have been circulated in the daily press. Now, however, the details of the invention have been obtained by the New York "Herald," from which the following interesting account and diagrams are taken:

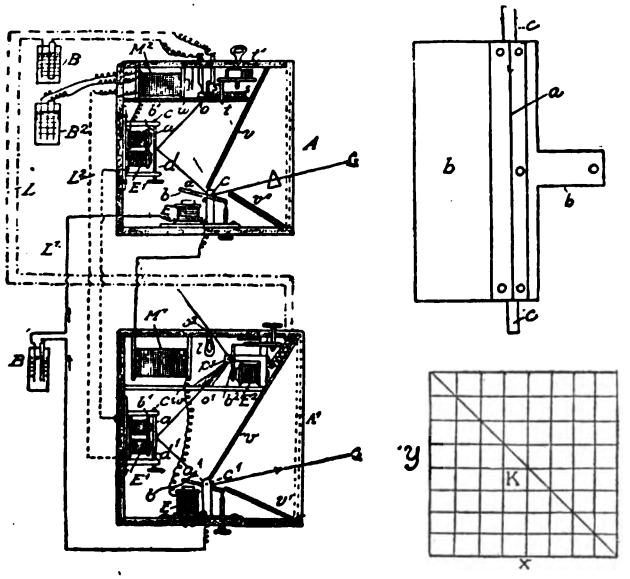
In Fig. 1 A represents the apparatus of the transmitting and A^1 that of the receiving station. The transmitter resembles the telephone box. Usually a telephone is connected with the telelectroscope to make conversation possible simultaneously with the sight of the object. In the telelectroscope the beams of light composing the picture are concentrated by means of a lens at G similar to the concentration of the sound in the mouthpiece of the telephone. The subdivision of the picture into single points is effected by two small reflectors, of which one is a (figure 1 A) and the other a d.

The reflector a is mounted upon a sheet of iron, the reflector being at a right angle of the diagram. By this reflector a (Fig. 1 and Fig. 2) a very small stripe of the picture G is reflected and in vibrating up and down the whole picture G will be reproduced stripe after stripe. The reflector's vibrations are effected by means of an electromagnet E, mounted below it, in a similar manner to the vibration of the membrane in a receiving telephone. At a right angle to this first reflector is a second reflector a d. The reflections cross one another in only a single point, and, therefore, the reflectors suitably vibrated, the whole picture must reappear in the reflector a d in form of consecutive points of light.

Digitized by Google

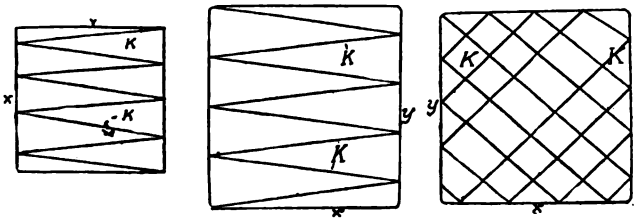
Figs. 3, 4, 5 and 6 illustrate the movement of those two reflectors in consideration. Let x be the direction of reflector a and y the direction of the reflector a d. Suppose both lines to be moving exactly in the same time over the same distance x and y, so line K must appear as the result of these movements as reflected picture at the point O (in Fig. 1) in the form of points following one another; in case the vibrations of the reflectors be always the same, the line K would be always repeated at O. If there be a greater difference in the vibrations of the reflectors the line K will look like Fig. 3 and Figs. 4 and 5.

In case the differences in the vibrations be small, Fig. 6 represents the line K. As will be seen by those figures, it will be possible by suitably regulating the vibrations of the two reflectors to subdivide and reflect the whole picture in the direction of O, Fig. 1. Suppose every reflector would make a hundred vibrations in a second, then 100 times 100 different points of light would result. But it is possible to bring up each reflector to several thousands of vibrations, and consequently the number of points will run up into the hundred thousands and millions.



FIGS. 1, 2 AND 3.

These points of light fall upon a plate of selenium, S. On this plate are mounted several selenium cells, because a single cell would not answer quickly enough to the necessary alternations. A clockwork keeps the plate in a constant rotation, offering to the light arriving in O always fresh cells. It may be mentioned that the point of light by suitable means must be enlarged so as to cover the whole selenium cell. At S an electrical current enters the selenium ring, leaving it near by, and, owing to the peculiar actions of light upon selenium, a larger or smaller amount of current is allowed to pass.



FIGS. 4, 5 AND 6.

The vibrations of the current thus produced arrive through the wires L at Fig. 1 A^1 the receiving station. Here at O^2 is a natural (daylight) or artificial (electric) source of light, the beams of which can enter into the apparatus through a very fine slot of variable width. The vibration of the electrical current effects also the enlarging or the reducing of the slot. Technical details of this part are not available, and there is much guesswork as to its nature. To understand the nature of the apparatus one has only to bear in mind that the brighter the point of light acting upon the selenium cell in the receiving apparatus the more current will be let through, and thus so much more the slot at O^2 will be opened. More light will enter, which will fall upon P^1, and from there upon the vibrating reflectors a d^1 and a^1 and from there to the ground glass G^1. The dark points of G allow less light to act upon the selenium cell at O (Fig. 1), less current will pass, less light will enter at o^2, and a dark point will appear at G^1.

To get a picture, as already stated, the motion of both systems of reflectors has to be synchronical; that is to say, the reflector a must swing as quick as a^1, and reflector a d as quick as a d^1, a condition which is met by telephones giving the same tone.

According to the testimony of eye-witnesses the transmission of pictures is perfect, and the central committee of the Paris Exposition of 1900, where the invention will be shown for the first time to the public, have guaranteed the young inventor 3,000,000 francs. At least, "that's what they say." We are not aware of the existence of a Central Committee of the Paris Exposition.

Second Annual Convention of the Independent Telephone Association, Chicago, June 30, July 1 and 2.

THE Independent Telephone Association of the United States met in its second annual convention at the Palmer House, Thursday, June 30, 4 o'clock p. m., and continued in session during Thursday evening, Friday, Friday evening and Saturday morning. The attendance was excellent, representatives from independent exchanges and toll lines being present from fourteen States. The interest manifested was great, and reports from all sections of the country showed a very vigorous growth and extension of the independent telephone movement throughout the United States. The programme as announced was carried out.

A committee consisting of H. D. Critchfield, of Ohio; S. P. Scherin, of Indiana, and H. K. Cole, of Kentucky, was appointed to propose changes in the constitution as adopted at Detroit in June, 1897. This committee submitted the following report, which, after full discussion, was unanimously adopted:

Your committee to which was referred the proposed changes to the constitution of the Independent Telephone Association of the United States beg leave to submit the following report:

We recommend first, that section 2 of article 3 be amended so as to read as follows:

"Section 2. The payment from time to time of such further assessments as the association, through its proper committee, may levy, not to exceed in any one year ten cents for each telephone in use by any exchange or toll line company, and ten cents per mile of toll lines carrying a wire or wires over which paid messages are transmitted."

We further recommend that section 3 of article 3 be amended so as to read as follows:

"Section 3. Any corporation, partnership or individual engaged in the manufacture of telephones and switchboards, or either, may become a member of this association upon payment of a membership fee of $10 and annual dues in the sum of $100. The membership fee to be paid but once, and the annual dues for the first year to accompany said membership fee, and be paid annually thereafter upon notification by the secretary of the association.

"Any corporation, partnership or individual engaged in the sale of apparatus or materials used in the construction, operation or maintenance of an independent telephone exchange, toll line or system, except such corporation, partnership or individual as may be engaged in the manufacture and sale of switchboards and telephones, or either, may become a member of this association upon payment of a membership fee of $10 and annual dues in the sum of $50, to be paid in like manner and time as hereinbefore provided for the payment of the same by manufacturers of telephones and switchboards."

Your committee further recommends that article 4 be amended so as to read as follows:

"Section 4. The officers of this association shall be a president, three vice-presidents, a secretary, two assistant secretaries, a treasurer and an advisory board consisting of nine members, two of whom shall be the president and secretary of this association, together with seven members, who shall be selected by the executive committee. The president and secretary of the association shall be ex-officio chairman and secretary of the

Digitized by Google

advisory board and executive committee, respectively, provided, however, that no person representing either himself or any firm or corporation admitted to membership under the provisions of section 3 of article 3 of this constitution, may be elected to or hold an office therein."

Your committee further recommend that article 3 be amended so as to read as follows:

"Article 8. Each member of this association shall be entitled to one vote for each 500 telephones or less, or for each 500 miles of toll lines or less, in actual use, and one additional vote for a major fraction of 500 telephones or miles of toll line in actual use, and no more, on the election of officers, or as to any question which may be voted upon by said association, provided, however, that each person, firm or corporation admitted to membership under section 3 of article 3 of said constitution shall be entitled to one vote."

Your committee further recommend that article 4 be amended so as to read as follows:

"The officers of this association shall be a president, three vice-presidents, a secretary and treasurer in one person, two assistant secretaries, and an advisory board, consisting of five members, two of whom shall be the president and secretary of this association, together with three others who shall be selected by the executive committee. The president and secretary of the association shall be ex-officio chairman and secretary of the advisory board and executive committee, provided, however, that no person financially interested in the manufacture or sale of telephones or supplies or materials used in the construction, operation or maintenance of a telephone exchange or toll lines shall be eligible as an officer or member of the executive committee of said association."

Your committee further recommend that article 5 of the constitution be amended so as to read as follows:

"The association shall elect an executive committee, which shall consist of one member from each State, each State through its delegates to suggest the name of the member of said committee to represent such State. Should any State be without representation in the convention the convention shall then select one member from such State, who shall act until the vacancy shall be properly filled under this article. The executive committee shall, with the consent of the advisory board, select such sub-committees, as it deems expedient and necessary, and shall fully empower such sub-committees to carry out the object for which they were created."

Your committee further recommend that section 3 of article 7 be amended so as to read as follows:

"The secretary and treasurer shall keep the minutes of the association. He shall collect all moneys and receipt for the same. He shall pay all properly executed orders and drafts provided for in this constitution, and all other orders signed by the president under the direction of the advisory board. He shall keep an accurate account of all receipts and disbursements of money, and make a report thereof at each annual meeting of the association, and to the executive committee and advisory board whenever called upon so to do. He shall issue and mail all official calls and perform all other duties required of him by the association. He shall receive such salary, not to exceed four hundred (400) dollars per year, as may be fixed by the executive committee, and shall have an allowance for expenses to be paid upon the approval of the advisory board on presentation of properly executed vouchers. His salary shall be paid at the end of each quarter by draft upon the treasurer. He shall give bond in such sum as the executive committee may require, with security to be approved by the advisory board."

Your committee further recommend that section 5 or article 7 be stricken out, and that the offices of secretary and treasurer shall be vested in one person.

Your committee further recommend that section 1 of article 7 be amended by striking out the words and figures "$2,500 per year," and inserting the words and figures "$1,200 per year," thereby reducing the salary of the president of the association from $2,500 to $1,200 per year.

Your committee further recommend that article 14 be amended so as to read as follows:

"The election of officers shall be by ballot whenever two or more names are presented for the same office, and shall be conducted by three judges and two clerks, to be selected by the presiding officer. The presiding judge shall announce the name of the voter before the ballot is deposited in the ballot box, and should any member challenge the vote the judges shall then proceed to hear the objection and shall determine the rights of the voter. No vote shall be cast upon the election of officers or any other question which may be voted upon at any meeting of said association except by a member thereof present in person."

These changes met with unanimous approval of the members present.

After the adoption of the report of the Revisional Committee the association proceeded to the election of officers, and the following were elected for the ensuing year:

President, James M. Thomas, Chillicothe, O.; first vice-president, H. C. Young, Columbia, Pa.; second vice-president, S. T. Slade, Oskaloosa, Ia.; third vice-president, J. B. Weare, Grand Rapids, Mich.; secretary and treasurer, W. J. Vesey, Ft. Wayne, Ind.; first assistant secretary, George W. Beers, Ft. Wayne, Ind.; second assistant secretary, D. C. Dow, Cobleskill, N. Y.; advisory board, James M. Thomas, Chillicothe, O.; W. J. Vesey, Ft. Wayne, Ind.; H. B. Critchfield, Mt. Vernon, O.; Hugh Dougherty, Bluffton, Ind.; E. B. Fisher, Grand Rapids, Mich.

After the election of officers and their assuming their respective duties, the following resolution was offered:

Whereas, The express companies have in many cities all over the country, presumably at the instigation of the Bell telephone monopoly issued orders directing the taking from their several offices such telephohnes as are not furnished free of charge,

And Whereas, We regard this act as a direct assault upon the independent telephone interests of the whole country,

Therefore, be it resolved, That the Independent Telephone Association of the United States in annual convention assembled, believing that just compensation for service and a right to enter into a fair competition in every line of business is the inalienable right of American citizens, do denounce this action of the express companies as an outrage upon the common rights of citizenship, which we advise and urge all the local independent companies to resent each in its own way, appealing to their patrons and fellow-citizens to aid them in their efforts by sending as many of their light shipments by mail or fast freight as possible, and we especially recommend that all independent telephone companies order all their own exchange and line supplies shipped in like manner.

This resolution, after full discussion and careful consideration, was adopted without dissenting vote.

After transacting miscellaneous business and general discussion, the association adjourned to meet in June, 1899, at a time and place to be hereafter fixed by the executive committee, unless sooner called in convention by the president.

Mr. Joseph Donohue, Western manager of the American Electrical Works, was on hand during the convention distributing packs of playing cards among the members and incidentally mentioning the merits of his wire. Mr. W. T. Blaine, the president and general manager of the Victor Telephone Manufacturing Company, was busy making many new friends among the delegates, as was also his electrician, Mr. E. E. Yaxley.

No electrical convention of any description would be complete without the presence of the genial W. W. Lowe, the popular president of the Electrical Appliance Company. Mr. Lowe came early and stayed late. Mr. Barron, representing the National Carbon Company, was an interested visitor. The interests of the Western Telephone Construction Company were well taken care of by Mr. Cooke, Harry C. Dodge and Mr. Platt. They made their headquarters in the lower floor in the north end of the hotel. Mr. James E. Keelyn, president of the Western Telephone Construction Company, did not put in an appearance until the second day, when he was warmly greeted by his old associates and friends. Mr. W. E. Doolittle was in attendance all three days, assisting the delegates in their trips to the new switchboard factory on West Quincy street, Chicago. Mr. Young, of the Columbia Telephone Company, circulated among his friends and presented his card as candidate for treasurer of the association. Mr. P. C. Burns, of the American Electric Company, added his six feet two inches to the throng and induced many of the delegates to visit his large factory on South Clinton street. James S. Healey, representing the Julius Andrae & Sons Company, Milwaukee, was also in attendance. The interests of the Stromberg-Carlson Telephone Company were in the hands of Mr. A. Stromberg and Mr. Henry Shafer.

The genial and portly James W. Brennan was present every day. Mr. Brennan is an old telephone man and knows everybody in the trade.

Digitized by Google

The electrical press was represented by Messrs. Kammeyer, Woodbridge, Church, Piny, O'Hara and W. J. McConnell.

SOCIETY & CLUB NOTES

Omaha Meeting of the Electrical Engineers.

THE American Institute of Electrical Engineers convened their 15th general meeting in the Trans-Mississippi Exposition City on June 27. Daily sessions were held in Royal Arcanum Hall, in the Bee Building, and were of special interest to all who attended during the four days' meeting.

The Institute met promptly at 9:30 o'clock Monday morning, and was called to order by Dr. A. E. Kennelly, of Philadelphia, president, who delivered the inaugural address, which was an excellent reviewing of the growth of electrical science in the decade and a half from 1884, the date of the birth of the Institute. He referred to the marvellous progress that has been made in all branches, in a financial, scientific and experimental way. His address was very exhaustive and sketched the great strides made in telegraphy, telephony, electric railroads, lighting and the less popular branches, down to the Roentgen rays and the wireless telegraphy, which is now passing through the experimental stage and will enter practical service in the future.

President Bingham, of the Omaha City Council, in a neat address welcomed the guests to the city, and was followed by President Wattles, of the Exposition, who pointed out the stupendous project they would witness and spoke at length upon the electrical features of the show.

Manager Edward Rosewater, of the Department of Publicity and Promotion of the Exposition, was introduced, and spoke of the aims and objects of the Institute. He related a number of anecdotes of the condition of telegraphy during the Civil War, when he was employed as chief telegraph operator at General Rosencran's headquarters a part of the time. Mr. Rosewater said that upon a certain occasion he had written to Prof. Bell, asking him for a list of books upon electricity, and was answered to the effect that there were no published authorities, and was advised to confine his studies to his own observation of electrical phenomena.

A royal welcome was also extended by Col. J. J. Dickey, Superintendent of the Western Union Telegraph Company, who greeted the visitors not only as a man engaged in the profession and a resident of Omaha, but also as a member of the Court of Ak-Sar-Ben. An invitation from King Sampson to attend the festivities in the den the same evening was also presented by H. J. Penfold, of the Board of Directors, later in the session and accepted.

The regular business was then introduced by the reading of the following papers: "The Dielectric Strength of Air," by C. P. Steinmetz, of Schenectady; "Two Wire Distributing Systems and Lamps of 220-240 Volts," by John W. Howell, of Newark, N. J.; "A Capillary Electrometer for Electrical Measurements," by Charles F. Burgess, of Madison, Wis. Mr. Howell was not present and his paper was read by Secretary Pope. After the reading of the papers the authors were called upon to answer many questions and take part in the general discussion which continued for a couple of hours.

In the afternoon the local committee of entertainment in charge of the guests visited the Grant Smelting Works and the Union Pacific shops, and at night were initiated as members of the Knights of Ak-Sar-Ben, where fun fast and furious raged for several hours.

Tuesday morning's session opened with the reading and discussion of George A. Damon's paper on "A Modern Electric Central Station." The paper proved to be a very interesting description of the modern plant of the Imperial Electric, Heat and Power Company at St. Louis, which Mr. Damon cited as a good example of the present tendency in electric power station practice. A discussion followed at some length on several other important papers, after which the Commitee on Standardization, comprising Francis B. Crocker, chairman; A. E. Kennelly, C. T. Hutchinson, J. W. Lieb, Charles P. Steinmetz, Lewis B. Stillwell and Elihu Thompon, presented their preliminary report. The object, as set forth in the report, is the consideration of necessary changes in order to secure uniformity and of what kind and size the apparatus in electric supplies should be. The report, which is not yet to be made public, was gone over section by section and discussed in a brisk interchange of ideas on phases of the matter. It was conceded that it would be desirable if a more generally approved system of standards was adopted.

The afternoon was given up to sightseeing at South Omaha. In the evening the party met at the Machinery and Electricity Building, where a special electrical display had been arranged by the General Electric Company, which was much admired. Afterwards the party, escorted by Luther Stieringer and Henry Rustin, of the Exposition, traversed the Grand Court, and for an hour or more enjoyed with highest delight the wondrous beauties of the grand illumination which it presents.

Later the Press Building was visited, where an invitation was extended to the guests by Mr. Stephen von Szinneyey, formerly of the Press Club, New York, now managing the famous German village (Deutsches Dorf) at the Exposition to visit the place, which was accepted unanimously, not a single dissenting vote being announced. Through the personal efforts of Mr. Luther Stieringer arangements were made with Gaston Akoun, of the "Streets of All Nations," and Henry Roltair, of "The Explosion of the Maine," for special performances, which were given at both places in honor of the distinguished guests.

Wednesday morning was devoted first to the reading of a paper by Ernst J. Berg, of Schenectady, on "Transmission and Distribution of Power for Railway Service." The paper was discussed at considerable length, and many valuable points relative to power and its general distribution were brought out.

Albert H. Armstrong read a paper on "Some Phases of the Rapid Transit Problem," and added to it a number of diagrams which he used as illustrations. This paper was of special interest to street car people, as it dwelt almost exclusively upon street car service. It discussed the points of power, fuel, cost and various phases of moving cars and people, the point being how to move the most people in the shortest time at the least cost.

A lengthy discussion followed the reading of the paper, which was participated in by Dr. Eddy, Mr. Arnold, Professor Goldsborough, Messrs. Steinmetz and Pope.

D. C. Jackson, Madison, Wis., not being present, his paper on "The Commutated Curve of a Composite Wound Alternator," was read by title. Other papers were referred.

The remainder of the day engaged the members in business and social intercourse, and at night, by invitation of the Omaha Street Railway Company, a trolley ride was accepted to visit Fairmount Park, Council Bluffs, Iowa, to which pleasure resort a ride of seven miles in a special car was enjoyed by the visitors and refreshments were supplied by the Committee on Entertainment in a generous manner.

The session on Thursday morning was opened by the reading of a paper on "The Graphic Treatment of Alternating Currents in Branch Circuits," by Dr. Eddy, of the State University, St. Paul, Minn., which was afterwards discussed at length in an interesting manner.

Prof. W. E. Goldsborough read a paper on "Air Core Distribution," which he illustrated with charts, and many valuable points were explained in a highly acceptable manner.

The paper of the day was then read by Charles F. Scott on "High Voltage Power Transmission."

Mr. White, Chairman of the Committee on Entertainment, introduced a resolution extending a vote of thanks to the Exposition Management, the Union Pacific Railway system, the Omaha Electric Street Railway Company, the daily press and to all others who had so kindly added in making the occasion one of genuine pleasure to the members of the Institute.

Mr. Steinmetz amended the resolution thanking the citizens of Omaha for their hospitality, which was adopted, as also the resolutions offered by Mr. White, of the Committee.

Mr. Pope spoke in terms of the highest praise of the papers read by the Western members, some of whom had not been heard at previous meetings. He went on to say that, although the attendance at the present meeting was not as large as at former ones, quality and not quantity should be considered, and in this respect the meeting had been the most enjoyable and successful ever held in the history of the Institute.

Digitized by Google

He congratulated the members on the creditable work done during the past year and also called attention to the telegraphers who had taken part in promoting the success of the meeting.

Dr. Kennelly closed in a very appropriate manner.

On motion of Mr. Steinmetz a vote of thanks was tendered to Prof. Owens, Superintendent of the Bureau of Machinery and Electricity at the Exposition. The latter made a short response, saying that it was a great pleasure to him to have assisted in entertaining the Institute.

The report of the committee to consider the plan of organizing the experimental resources of the various electrical laboratories in the United States was read by Chairman Owens. This report is only preliminary, and recommends the Council to take this matter in charge. The report was adopted.

The plan is to send circular letters from the committee to persons in charge of the laboratories requesting them to join in the movement and explaining the object in full.

Among those of the Committee on Arrangements instrumental in promoting the pleasure of the visitors and in doing all in his power to have them remember the Omaha meeting for years to come was Mr. Edward F. Schurig, City Electrician of Omaha, whose polite attention and kindly consideration of the needs of the members will serve as one of the pleasant associations to mark the fifteenth mile stone of the American Institute of Electrical Engineers. A pleasant time afterwards spent in songs and toasts and taking farewell ended the meeting held in the Exposition City. The same evening many of the visitors departed homeward, while others prolonged their visit a few days in order to see still more of the enjoyable sights which Omaha this season affords.

NEWS & NOTES

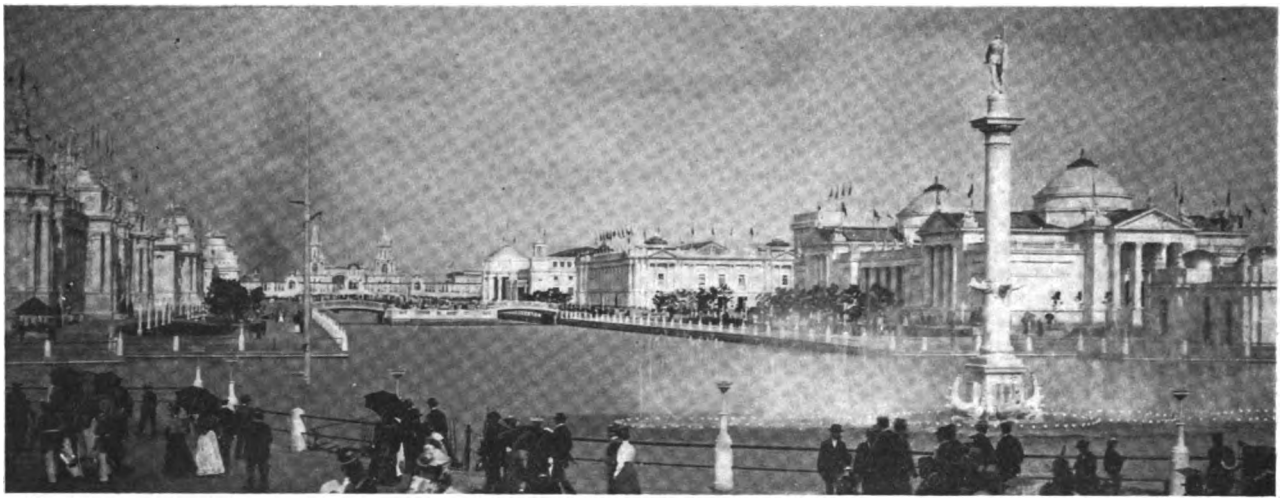
Illumination of the Grand Court at the Omaha Exposition.

BY MABEL BALCOMBE.

NOT only has the grand court of the Exposition at Omaha a fine showing of stately buildings and colonnades, sweeping arches and golden domes, a lagoon, fountain-splashed and spanned by delicate bridges, statues, terraces and tropical plants, but its salient and distinguishing feature is the exquisite blending of these elements. The perspective evolved through the artistic arrangement of color proportions and sky lines surpasses in charm all previous expositions. Every building is a lovely unit to an impressive whole; every colonnade—which serves also the practical purpose of a sheltered promenade between the buildings—forms the exact curve or straight line best adapted to enhance the surrounding structures. The court is about one-half mile in length and 700 feet across; a lagoon forms the centre, and is surrounded on three sides by seven of the principal buildings, erected in the renaissance and classical styles, and covered with white staff. The place of honor at the west end of the lagoon is occupied by the superb Government building, which resembles St. Peter's in many respects, and may be claimed as superior in design to the corresponding one at Chicago. In front of this structure the lagoon widens out in a clover-leaf effect, to hold the great cloud-like electric fountain "Nautilus," which plays continually, as shown in the accompanying illustration. A very full illustrated description of this fountain, built from the designs of the well-known electrical expert, Mr. Luther Stieringer, was published in our May 19 issue, with a plan of its pipes and valves. As is evident from the illustration, it is of spray formation and is an embellishment to the scene rather than a separate display.

GOVERNMENT BUILDING AND ELECTRIC FOUNTAIN, OMAHA EXPOSITION.

Looking from the Government building down the north side of the lagoon, the Agricultural, the Manufacturers and the Machinery and Electricity buildings are seen successively; down the south side, the Fine Arts, the Liberal Arts and the Mines and Mining buildings, any one of which, if adequately described, would deserve a separate article. The eastern end of the court is enclosed by a curved colonnade, with the two effective towers of an outside building looming up from behind. It is connected in the rear with a viaduct, and is the spot par excellence from which to view the splendors of the grand court by day and by night. Credit for the former is due the architects-in-chief, Messrs. Walker & Kimball, whose instructions to the architects



GRAND BASIN, OMAHA EXPOSITION, SHOWING NAUTILUS ELECTRIC FOUNTAIN AND COLUMN OF NEPTUNE.

Digitized by Google

under them extended even to the proportions, height and style of the different edifices. For the splendid illumination, which is one of the brilliant successes of the enterprise, honor is due Mr. Luther Stieringer, as consulting electrical engineer, from whose designs it was accomplished, and Mr. Henry Rustin, electrical engineer, under whose supervision the entire electrical work of the Exposition has been executed. Although in this instance his entire plan was made before a building was erected, not a light of the many thousands used has been changed. The entire scheme is carried out in 8 and 16 c. p. incandescents. The lower lights outline the bridges, gleam among the shrubbery and surround the fountain Nautilus, like brilliant water lilies floating upon the surface of the pool. On the sprays of white mist and crystal drops searchlight beams in red, green, purple, etc,. are cast. Immediately surrounding the lagoon, at frequent intervals, standards about ten feet in height bear clusters of incandescents. Back of these and higher, lines of incandescents bring into relief the pillars of entrances and colonnades, also caps of columns, pedestals and points of vantage. Higher, and receding in the background, roof cornices are encircled, then, above all, domes and spires and towers. On the roof of the Government building flambeaux are raised in standards. Above them, the mammoth dome is outlined in glittering bands; higher up the lights encircle the cupola, then climb to the statue of the Goddess of Liberty and finally blaze from her torch. The perfect diffusion of the light; the carefully studied heights; the absence of arc lights and crude display effects; the art that accentuates instead of overwhelming the beauties of the architecture—all these have produced a most artistic and complete illumination.

Electricity in a Modern Stable.

THE electric motor has become a necessary adjunct to every well-appointed modern stable, whether livery or private, and horses are now groomed and clipped by electricity, with both neatness and dispatch.

The advantages of the application of the electric motor to grooming and clipping machines were early realized by the

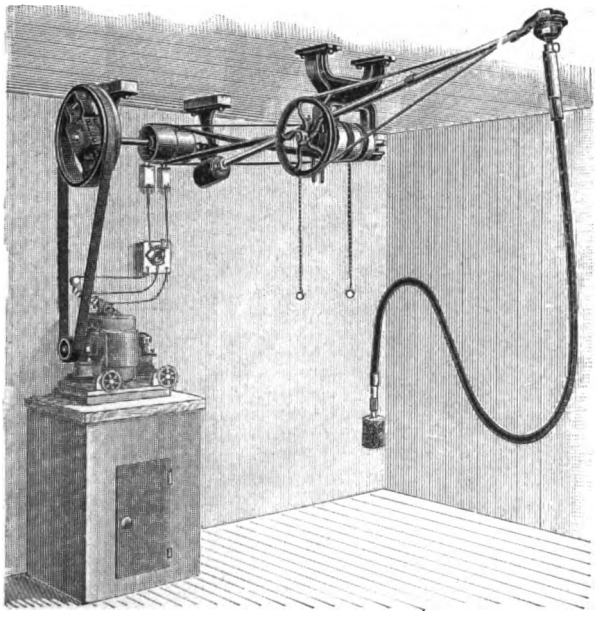


FIG. 1.—OLD METHOD OF DRIVE THROUGH DOUBLE COUNTERSHAFTING.

Amercian Shearer Manufacturing Company, of Nashua, N. H., and its effort toward supplying a demand for electrically-driven groomers and clippers has met with considerable success. Hitherto, however, it has supplied merely the machinery, exclusive of the motor, but owing to a demand which has arisen for complete grooming and clipping installations, it is now supplying the motor as well. In doing this, however, it has found it is necessary to simplify in a large measure the driving mechanism.

Fig. 1 shows the No. 8 grooming and clipping machine, driven by a bipolar motor through double countershafting with conical and idle pulleys. This method, while it allows of the operation of two or more groomers and clippers from one motor, was by no means satisfactory on account of the complication of belts and pulleys necessary, and when it became a question of furnishing both driving and operating machinery it was felt that some more direct method of drive was needed. This was found in the small power moderate speed motors developed by the General Electric Company, which, in addition to its line of small power induction motors, has also recently perfected a line of direct current small power motors known as the C. A. type. These motors may be run in any position, either attached to the wall, set on a bracket or hung from the ceiling, and have been found peculiarly adapted to drive the groomers and clippers of the American Shearer Manufacturing Company.

Fig 2 shows the No. 9 machine complete with a 1 h. p. C. A. motor and automatic starting rheostat. In this case no floor space is occupied by the motor and countershafting is eliminat-

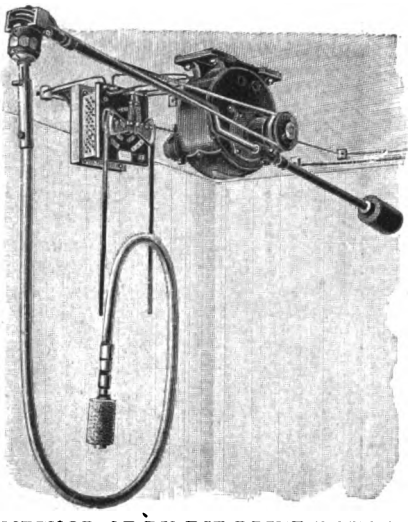


FIG. 2.—NEW METHOD OF DIRECT DRIVE WITH C. A. MOTORS.

ed, and the belting is reduced to a single belt from the motor pulley to the pulley attached to the flexible shaft of the groomer and clipper. The motor is fastened to the ceiling beams in an inverted position and the counterpoise, or balance arm, is attached to a swivel on the motor case. The automatic starting box, also fastened to the ceiling, is of the reversing type, with the contact arms pulled in either direction by leather straps. This clipping and grooming outfit is singularly compact and simple and requires almost no attention beyond an occasional oiling. In ordering, it is simply necessary to state the nature and voltage of the current, and, if alternating, the phase and number of alternations.

With the electric motor driven groomer and clipper a horse may be thoroughly brushed in about two and one-half minutes and clipped in about thirty-five minutes.

THE STOCK MARKET

Holiday Dullness and Strength.

The holidays have interfered with the run of the markets and the course of trade, but conditions are steady and strong, and the glorious news of the glorious Fourth at Santiago has given an upward tendency this week to stocks. It is curious to note the steadiness of prices from the memorable Maine day, February 15, to July 1. General Electric was then 38¼. It has gone down to 29¼ and is now back to 39. Western Union was then 92⅞. It has been down to 82¼ and on July 1 was 93. Bell Telephone closed the week at 280.

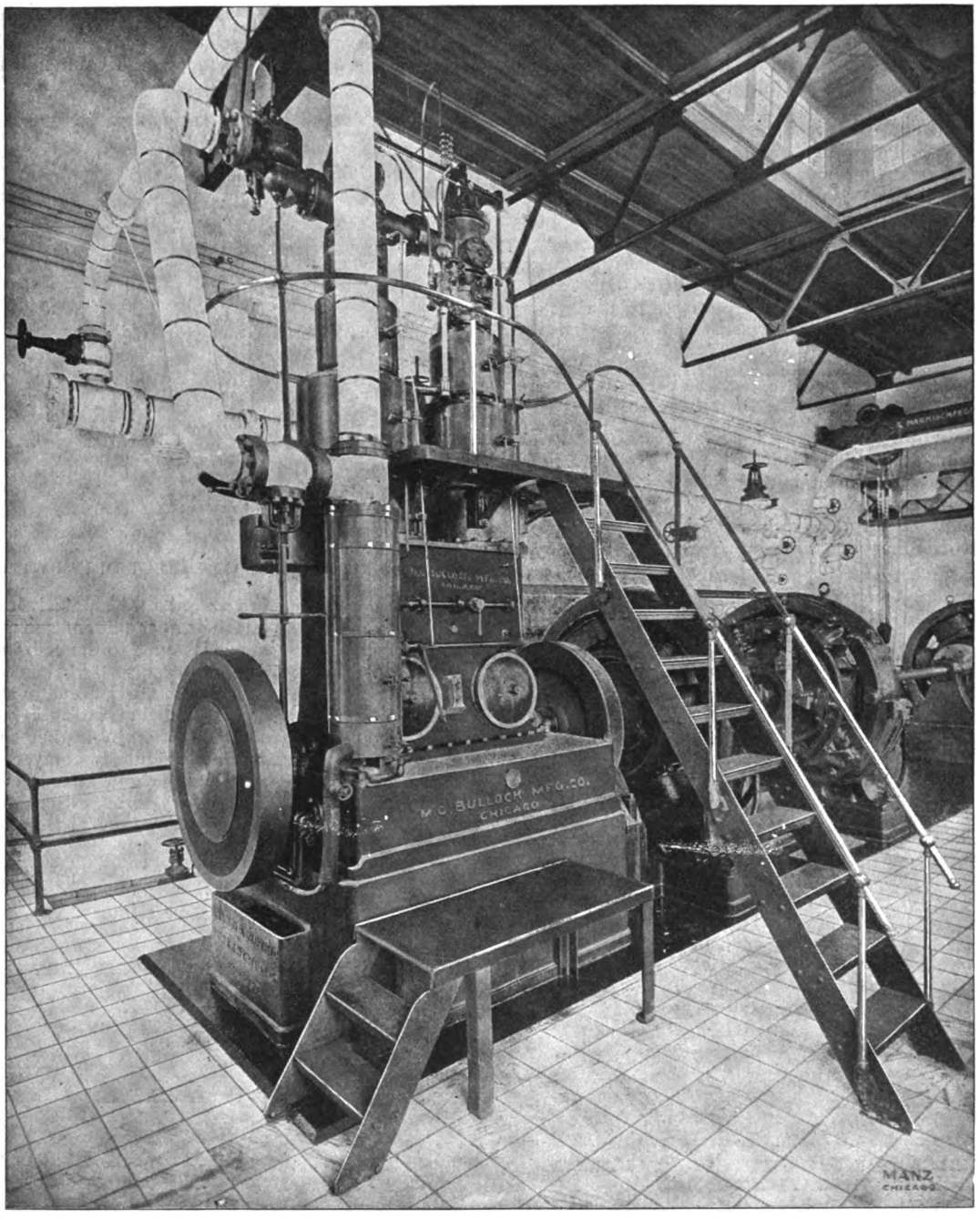
BOSTON, MASS. The Boston Electric Light Company has ordered from Mr. S. M. Hamill, general manager of the Brush Electric Company, 20-160 arc lighters for their new station.

Digitized by Google

TRADE NOTES AND NOVELTIES

The Bullock Central Valve Engines.

THE illustration on this page shows a triple expansion transfer condensing "central valve" engine of 200 h. p. coupled direct to a street railway generator, running at 380 revolutions per minute, at South Englewood, Chicago, Ill. The engine, which was manufactured by the M. C. Bullock Manufacturing Company, 1170 West Lake street, Chicago, embodies some admirable features which have won for the central valve engine much well-deserved praise. It is very economical in the use of steam, as less than 13 pounds per i. h. p. h. has been recorded under suitable conditions of size and pressure. A consumption of less than 14½ pounds can be guaranteed in engines of only 80 h. p. with 160 pounds steam pressure. Even non-condensing engines show a consumption of only 18.7 pounds. The engine is equipped with a very efficient system of automatic lubrication and requires little attendance. The engines are single acting and, there being no reversal of stress on bearings, all parts are always kept in constant thrust. The engines are very compact, therefore occupy small floor space, and are made of the best materials, all parts except the base being built of steel or semi-steel. All parts are interchangeable, and to show how well these engines work under full load, it should be stated that a number of them have been running under full load for periods ranging from 30 to 90 days, without once closing the throttle. Over 200,000 h. p. of these engines are now in use, and, being economical, silent, durable and reliable, they have given entire satisfaction wherever installed.



TRIPLE EXPANSION TRANSFER CONDESER CENTRAL VALVE ENGINE OF 200 H. P., COUPLED DIRECT TO STREET RAILROAD ELECTRIC GENERATOR, RUNNING AT 380 REVOLUTIONS PER MINUTE, AT SOUTH ENGLEWOOD, CHICAGO, ILL.

PROF. W. D. MARKS has been elected president of the new General Electric Automobile Company, recently formed in Philadelphia.

Digitized by Google

New Rushmore Marine Generating Set and Projector.

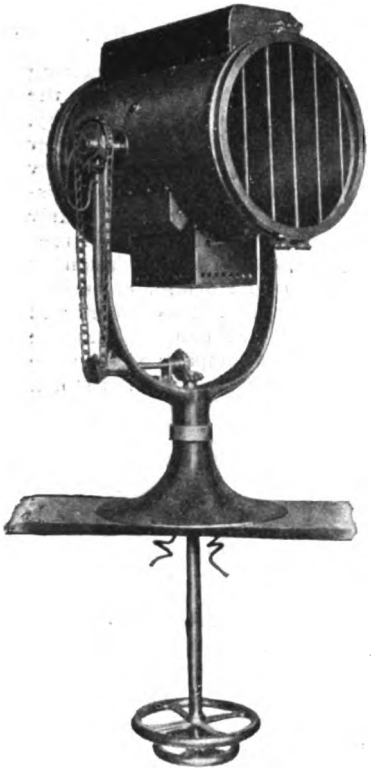


FIG. 2.

WHILE the war undoubtely has a disturbing effects on business, it has created a boom in some lines of electrical work, and manufacturers of marine lighting equipments have been reaping a harvest. Among the more fortunate ones are the Rushmore Dynamo Works, of Jersey City, N. J., who, at the beginning of war, realized that there would be a great demand for their goods and at once commenced working to their utmost capacity. They were thus able to meet all the demands of the Government for the equipment of the large fleet of auxiliary and transport vessels, and in the past sixty days they have shipped over 100 complete searchlight equipments.

We illustrate herewith some of the latest type apparatus built by this company, who have for years made a specialty of marine equipments. Fig. 1 shows their latest type marine generating set with multi-voltage dynamo rated at 15 k. w. at 500 revolutions per minute. The engine is built after the latest torpedo boat practice, all parts are of finished forged steel, and the governor is of the improved Rites pattern and controls the speed within one-quarter of 1 per cent. In the cut, the

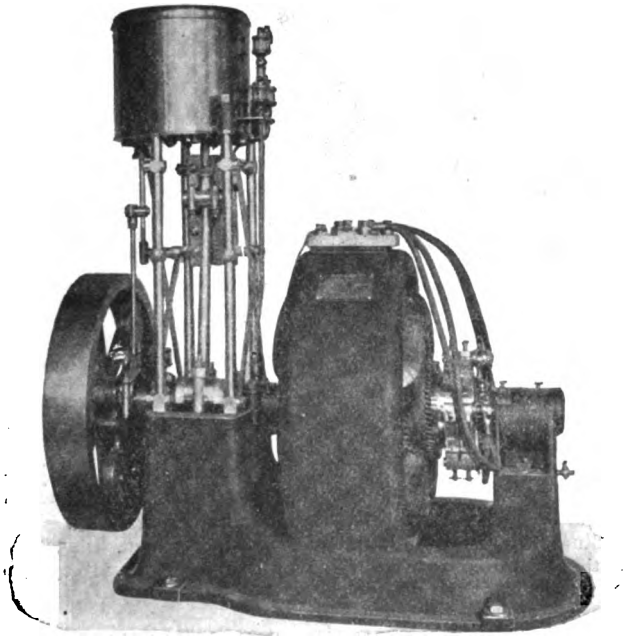


FIG. 1.

splash guards are removed to show the working parts. The dynamo operates on the Rushmore multi-voltage system. It has a simple parallel armature, and will deliver its entire output to a single circuit at one voltage or at as many different voltages and to as many entirely separate circuits as there are pairs of poles.

In marine plants with storage batteries the machine runs in parallel with the battery at full load, and at light load one pair of brushes is connected at the switchboard to the lighting circuit and the other pair is connected to the battery, the voltage on the battery being increased to any amount required to charge the cells. This does away with boosters and wasteful resistance. It is a great improvement for shipboard, as it has always been necessary heretofore to run the dynamo all day to charge the batteries, even though they form but a small load for the plant. The machine is exactly the same as other multipolar dynamos, the only difference being in the method of connecting up. It works on the same principle as their larger dynamos used in connection with feeder and main and elevator systems.

Fig. 2 shows the new type Rushmore pilot house projector. The same apparatus is made with a tall base for mounting on deck, while the 24-inch and 30-inch sizes built for the navy have two small motors in the base with wires leading to a distant controller for swinging the beam in any direction.

The Victor Telephone Mfg. Co.

The above-named company made its bow to the telephone public at the second annual convention of the Independent Telephone Association, having secured parlors D and E at the Palmer House, immediately adjoining the convention hall. On account of the company having been organized but a short time, the exhibit was not as complete as might be wished. The apparatus shown, however, gave all callers an excellent idea of the high grade of apparatus now ready to be put on the market by the Victor Manufacturing Company. This company does not enter the field of manufacture with new and untried apparatus, but has the advantage of years of experience and practical knowledge on the part of its engineers. The company will manufacture only one grade of apparatus, and that the best, incorporating in it the many details of construction found to be either necessary or desirable in apparatus of this kind.

The company some time ago equipped its factory at 166-174 South Clinton street with all necessary tools and appliances to produce a superior line of exchange and line equipment of every description, from the smallest 16-drop switchboard to the largest exchange equipment capable of taking care of 3,000 or more subscribers.

Other apparatus of the company's make will shortly be fully described and illustrated. A few words of the personnel of the company may prove of interest to our readers. Mr. W. T. Blaine, the general manager of the company, is a business man fully competent to take proper care of the many details entering into the operation of such an industry as the Victor company bids fair to have within a short time, orders already received being sufficient to keep the factory going full force for some time. Mr. E. E. Yaxley is a telephone engineer and expert of some twelve years' experience in both the theoretical and the practical field, and his knowledge of the requirements of the business will do much towards enabling the company to supply successfully the demands of the independent telephone field.

A Successful Boiler Compound.

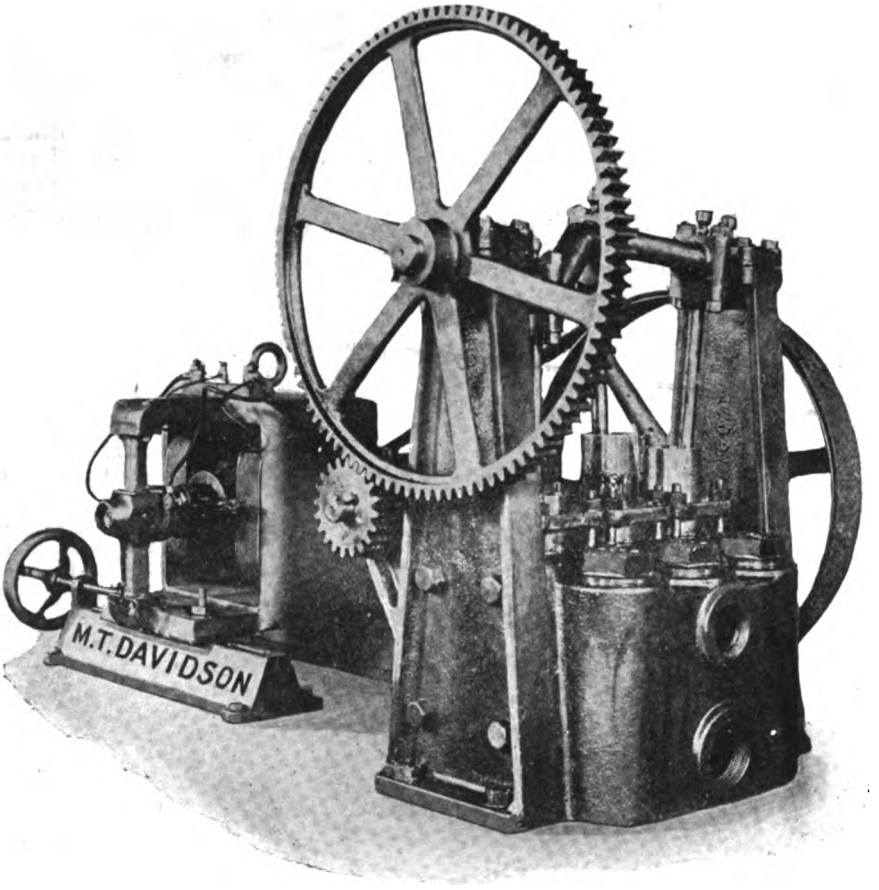
ONE of the greatest annoyances to the central station manager and attendants of boilers has been the scale forming on the inside of their boilers. This nuisance, which is frequently unavoidable on account of the quality of the water used, is a most objectionable feature, as it forms a non-conducting body between the iron and water, resulting in a loss of fuel. Many compounds have been placed on the market within recent years to remove this dangerous scale from boilers, tubes and flues, but it must be admitted that the majority have proved unsatisfactory. A very successful compound, however, and one which, by practical investigations on a large scale and on the strength of the reports of a large number of stationary engineers, has fully justified the claims of its manufacturers, the Boiler Expurgator Company, of 113 Dearborn street, Chicago, Ill., is called the "Boiler Expurgator." It removes incrustation from either salt or fresh water, eliminates all foreign substances held in solution, keeps the heating surface clear of incrustation, and effects a material saving in the consumption of fuel. It is galvanic in its action and is easily applied, this being done only when a washout is made. It will prevent foaming and allow the boiler to be run a longer time between washouts. The expurgator is in use in

Digitized by Google

numerous plants throughout the civilized world and the business of the company is steadily increasing. The selling agents are: William Lambert, San Francisco; Caldwell Bros., Tacoma, Wash.; Hendrie & Bolthoff Manufacturing Company, Denver, Colo. Besides the expurgator, the company manufacture engine and cylinder oil filters, which will be sent to anyone on a 30 days' trial with full instructions for use, and if not satisfactory can be returned at the end of the trial. Prices, literature and details will be cheerfully furnished by the company.

Davidson Vertical Triplex Pump.

THE well-known firm of M. T. Davidson, manufacturers of improved steam pumps and hydraulic machinery, whose principal office and works are located at 43-53 Keep street, Brooklyn, N. Y., with branch offices at 133 Liberty street, New York, and 30 Oliver street, Boston, Mass., have within recent years brought out a great variety of electrically driven pumps. One of their latest and most improved patterns is the vertical triplex pump, illustrated below, which was designed to operate in connection with an electric motor, by belt connection, or gearing from a line of shafting. The cranks of the pump are so set that the plungers are brought on the water column without shock from the reverse stroke, thus insuring an even and steady delivery. The workmanship and material employed are the very best attainable and each machine is thoroughly tested before it leaves the works. The pumps are made in five sizes, with delivery capacities ranging from 10 to 112 gallons per minute at a speed of 75 revolutions per minute and horse power ranging from 1.1 to 11.7.



DAVIDSON VERTICAL TRIPLEX PUMP.

Various types of motors are supplied with the machines, the C. and P. ironclad motor being preferred on account of its special design for heavy duty. As will be seen on the engraving, the field coils are square-shaped and the pole pieces project inwardly from the massive field frame. The motor is well ventilated, strong and supplied with self-oiling bearings.

A large number of these outfits have been installed by the firm and have given entire satisfaction everywhere. A new catalogue describing the numerous types of pumps and condensers manufactured by the firm has lately been issued and will be sent to anyone on application.

Scaling Down General Electric Stock.

The directors of the General Electric Company, at a meeting held last week in New York City, voted to recommend to the stockholders a reduction in the share capital of the company, both common and preferred, of 40 per cent., so that each holder of 100 shares of present stock will get 60 shares of the new stock. An official statement says: "This settlement, while satisfactory to the common stockholders, is regarded as particularly favorable to the preferred shareholders, inasmuch as it will render unnecessary the taking of any steps for the liquidation of the company, in which event the preferred stockholders would receive only the same amount as the common stockholders and no back dividends. The plan now adopted contemplates the payment, from the surplus earnings of the company as they are hereafter made, of the accrued dividends on the preferred stock. On the basis of the new capitalization $1,275,000 will be required annually to pay 7 per cent. upon the preferred stock and 6 per cent. upon the common stock."

The stockholders will act upon this proposition for a readjustment of the company's capital stock at a special meeting which has been called for August 10, at noon, in Schenectady. The outstanding stock is: Common, $30,460,000; preferred, $4,252,000. Under the proposed reduction it would amount to $18,276,000 common and $2,551,200 preferred.

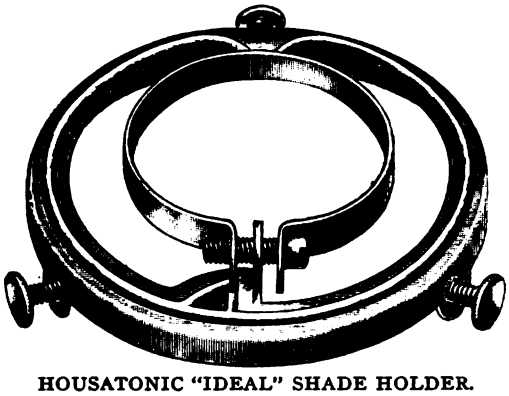
UNITED GAS IMPROVEMENT COMPANY, of Philadelphia, Pa., are making extensive additions to their gas-producing plant. These plants are known as the 25th Ward and the Point Breeze locations. At the 25th Ward Gas Works they are building a new scrubber house, 45 feet wide and 120 feet long; a purifier house, 86 feet wide and 180 feet long. At the Point Breeze Works they are erecting a new boiler and engine room, 220 feet long and 55 feet wide; a condenser building, 40 feet wide and 105 feet long; a purifier building, 86 feet wide and 180 feet long; a generator house, 100 feet wide and 184 feet long; a

Digitized by Google

meter house, with additions for exhaust and valve room, having a width of 70 feet and a total length of 223 feet. All of these buildings are of steel frame construction, brick side walls and slate roofs, supported on metal purlins carried by clear span trusses. All the structural steel work for this extensive plant is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

Housatonic Co.'s "Ideal" Shadeholder.

THE Housatonic Company, of Wallingford, Conn., with office at 253 Broadway, New York City, have just put on the market a new electric shade holder called the "Ideal," and anyone interested in an article of that kind should examine it before placing his orders. It fits every socket perfectly and is very easy to apply, as it will slip over the end of any socket without having to take the screw entirely out. It is made in one



HOUSATONIC "IDEAL" SHADE HOLDER.

piece, insuring rigidity, and there are no parts to work loose. It is very nicely ribbed throughout, giving it great strength and also ornamentation. The adjustment is perfect, as the lamp is always held in the centre. It has the largest capacity and also the smallest adjustment. Circulars and information will be furnished on application, and it is suggested that prices be written for, as they will prove interesting at once.

Knapp Motor and Gordon Cell Outfits.

The splendid fan outfits consisting of Knapp fan motors, manufactured by the Knapp Electric and Novelty Company, of 47 Warren street, New York, and the Gordon cells, manufactured by the Gordon-Burnham Battery Company, of 594 Broadway, which have previously been described in our pages, are meeting with universal favor and the most satisfactory results. The outfit is economical, handy and up-to-date, and the Knapp Company report that their sales of Knapp outfits for June this year are far in excess of the sales for the corresponding month of last year.

Swinging Ball Lightning Arresters.

Every spring and summer season brings a number of new devices for lightning protection. Many of these are on the market for only one season and are then not heard from again. It is probably this fact that gives the Electric Appliance Company great satisfaction in calling attention to the "Swinging Ball" lightning arrester, which has now been on the market for nearly ten years with uniformly successful results. It is made in practically the same way to-day as when first put on the market, showing that the inventor evidently succeeded in producing a satisfactory device. The Electric Appliance Company, as general Western agents for the "Swinging Ball" lightning arrester, carry a large stock in Chicago, and reports that each year brings an increased sale of this specialty.

THE WARREN-MEDBERY COMPANY have about completed the addition to their works, at Sandy Hill, N. Y., and are setting up some very heavy machinery, to be used in the construction of their inductor alternators. The sale of these machines is steadily increasing and the works are running to their utmost capacity. The line of knife switches which they are producing is very extensive and the demand is rapidly improving.

CATALOGUES.

Harrison Safety Boiler Works.

Quite in conformity with all their other literary productions the Harrison Safety Boiler Works, of Philadelphia, Pa., have issued a very handsome and exhaustive catalogue, illustrating the Cochrane separators and appliances for removing liquids or solids from steam and other vaporous or gaseous currents. The catalogue is amply and beautifully illustrated, showing the various portions of the separator, the numerous styles manufactured by the company, complete price lists and users of the separators for live and exhaust steam, compressed air, ammonia gases, etc. The catalogue is well indexed and will be sent to anyone on application.

The Massachusetts Fan Company.

The above company, located at 63 State street, Boston, Mass., have just issued a very complete catalogue illustrating the Davidson ventilating fan wheels and other forms of ventilating apparatus for use in mills, schools, public buildings and general ventilation. Many different styles of Davidson fans are illustrated and the particular advantages of the blades, frame, self-oiling bearings and other excellent features are pointed out. The Davidson fans are said to be very economical, strong and noiseless, give uniform delivery and create no back draft. A number of direct connected fans with various styles of motors are shown, as well as one direct connected to a steam engine. The back pages of this interesting catalogue are taken up with illustrations of various well-known public buildings in which the Davidson fans have been installed.

Zimdars & Hunt.

The general catalogue of Zimdars & Hunt, the well-known manufacturers of high grade electric light and power specialties, 127 Fifth avenue, New York, has just made its appearance. This catalogue includes under one cover the three special catalogues recently issued by this firm and which have been noted in these columns. The catalogue is divided into three sections, A, B and C, corresponding to their three special catalogues bearing these letters. Under Section A we find illustrated and described all types of this concern's well-known knife switches, lugs, connections, instrument switches, switchboard fittings, etc. Under Section B are treated their high grade panel boards, feeder boards, etc. This section has special value from the fact that up to the time of the issue of this section no complete and comprehensive catalogue bearing on these subjects has been available. The information to be found herein is very complete. Section C is given up entirely to the well-known automatic switches and motor starters of their manufacture. A great variety of types are shown for pump, elevator, crane and such work.

The cover is in imitation of marble with copper embossing, and is very handsome in appearance.

The catalogue as a whole is very complete and should prove of great value to engineers, contractors and supply men. It can be obtained by addressing the above firm.

A Useful Data Sheet.

Mr. George Kirkegaard, 28 State street, New York, has compiled and published what appears to be a very useful machinist's and draftsman's data sheet. It is designed to save time in machine shops and is intended to go directly into the hands of the workmen at the bench, who will tack it up in front of them or on the cover of their tool chest. Mr. Kirkegaard, being a practical man, has observed the need of such a thing and has selected with great care the information most frequently needed by the mechanic. A number of the tables are quite original, as, for instance, the one giving the size of drill for tap holes, which is not to be found in any pocketbook. This data sheet is believed to be a great money saver to all mechanics, as it will save them a great deal of time. The price of the data sheet on heavy paper is 15 cents, on cardboard, 25 cents, and a discount will be

Digitized by Google

quoted by Mr. Kirkegaard to anyone wishing to order the data sheet in quantities.

I. P. Frink.

The great church light patent reflectors and chandelier reflectors manufactured by I. P. Frink have won such universal favor among architects and engineers that this firm can point to the proud record of having lighted over 20,000 churches. The reflectors have also been installed in large numbers in halls, theatres, art galleries, stores, store windows, banks, schools, hospitals, office buildings, public buildings, etc., for which purpose they are admirably suited. A booklet on light and estimates will be sent free to anyone on application to I. P. Frink, 551 Pearl street, New York.

ADVERTISERS' HINTS

THE WHEELER REFLECTOR COMPANY, Boston, Mass., say the connecting link from sunset to sunrise is found in their reflectors, which are designed for every kind of lighting.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., advertise four styles of transformers for power transmission service. These are the self-cooling oil filled, self-cooling dry, dry with auxiliary air blast cooling device and oil filled with auxiliary water cooling device. They build them in units of any size and for any ratio of voltage.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, Ill., say the swinging ball lightning arrester has the longest record of unbroken success of any arrester on the market and that where properly used it never fails.

THE WESTERN ELECTRIC COMPANY, Chicago and New York, advertise iron armored, brass armored and plain interior conduit, conduit fittings and conduit tools. Their stock is large and their prices are pleasing.

THE ELECTRIC GAS LIGHTING COMPANY, 192 Devonshire street, Boston, Mass., claim the "Samson No. 2" battery to be without a peer for telephone use.

ZIMDARS & HUNT, 127 Fifth avenue, New York, have just gotten out their new catalogue of electric light and power specialties. Better send for it.

SAMUEL MANKOWITZ, 141 South Clinton street, Chicago, Ill., is manufacturing weather-proof wire which he guarantees to be a high grade article at a low price.

BIBBER-WHITE COMPANY, 49 Federal street, Boston, Mass., announce that they have acquired by purchase all rights, title and interest in the stock, tools, factory and good will of the the American Electric Company, of Boston, the manufacturers of the "New Era" and "Victor" burners. A large stock will be constantly kept on hand, facilitating prompt shipments.

THE PHOENIX ELECTRIC TELEPHONE COMPANY, New York, call attention to the thorough equipment of their large factory for the manufacture of telephones and telephone apparatus.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, advertise transformers in units of any size.

WESTERN NOTES

THE CUTLER-HAMMER MANUFACTURING COMPANY, 70 to 82 West Jackson street, Chicago, report that since their consolidation with the American Rheostat Company they have been working overtime in order to meet the demands for their goods; and they have more men in their employ than ever before. Mr. J. G. Hickcox, secretary of the company, says: "We have received large foreign orders, and if the increase in business continues, we shall be obliged to seek larger quarters."

EUGENE MUNSELL & CO., of 117-119 Lake street, Chicago, are sending to their Western customers a very neat blotter, on which are embossed the Cuban and American flags, under which are the words "Victorious on Sea and Land." The printed matter beneath these words refers to the rapid development of a great business in a great city.

IMPROVED TURN-BUCKLES. The Central Electric Company, of Chicago, are carrying in stock an improved type of turn-buckles, both galvanized and plain, which can be furnished with hook and eye, double hook or double eye. These goods are standardized and constructed with a view of great strength being secured.

MORROW COUNTY TELEPHONE CO., formed recently at Mt. Gilead, O., has an American Express board of 200 drops and 140 subscribers, with 150 miles of toll line. The residence rates are $12 and business $24 per year. The capital stock is $12,000. A. A. Whitney is president; V. Peck, vice-president; H. B. McMillen, secretary and treasurer, and C. W. Schaaf, manager. The company is extending its toll system steadily.

NEW YORK NOTES

J. B. COLT & CO., 3 to 7 West Twenty-ninth street, who for years past have been prominent in the business of making and selling projection lanterns and the like apparatus, announce their intention to close out this branch. They are going to devote their energies more particularly to the sale of acetylene gas generators for the lighting of all kinds of buildings, etc. On account of this decision they are offering special opportunities in price to buyers of projection apparatus, arc focusing lamps, magic lanterns, stereopticons, slides and other accessories.

HEBER WELLS.—Many of our readers who manufacture electrical machinery are interested in pattern letters and figures for the various parts of patterns used in the course of manufacture. In that line Mr. Heber Wels, 155 William street, this city, carries a large and varied stock. He informs us that one of the most skilled machinists in this country, after trying many styles for the numbering of patterns, has chosen the Doris as the best general figure. The face is rounded, and the figure draws from the sand with less breaking down than any other style.

CONTENTS.

EDITORIALS:
Standardization of Electrical Apparatus and Nomenclature 10
Tests with an Induction Generator 10
Bell Telephones in Use 11
Women Car Conductors 11
POWER TRANSMISSION:
The Reno Inclined Elevator in a Department Store (illustr.) 1
ELECTRIC LIGHTING:
Notes on Some Central Station Meter Tests (illustr.) ..... William D. Ennis, M. E. 3
Electricity in Baltimore—Notes from the Field ..... C. B. Fairchild. 5
MISCELLANEOUS:
Transformer Economy ..... W. E. Goldsborough. 6
Electricity on Board the Hospital Ship Relief.—A Statue of Franklin for Philadelphia (illustr.) 9
TELEPHONY AND TELEGRAPHY:
Practical Features of Telephone Work—XVI. (illustr.) . A. E. Dobbs. 12
The Evolution of the Telephone Line Signal—I ..... Arthur Vaughn Abbott. 13
The Sczepanik Telectroscope (illustr.) 14
Second Annual Convention of the Independent Telephone Association, Chicago, June 30, July 1, 2 and 3 15
SOCIETY AND CLUB NOTES:
Omaha Meeting of the Electrical Engineers 17
NEWS AND NOTES:
Illumination of the Grand Court at the Omaha Exposition (illustr.) Mabel Balcombe. 18
Electricity in a Modern Stable (illustr.) 19
THE STOCK MARKET:
Holliday Dullness and Strength 19
OBITUARY:
Mrs. Charles E. Newton 11
MARRIED:
Ward—Clarke 11
TRADENOTES AND NOVELTIES
The Bullock Central Valve Engine (illustr.) 20
New Rushmore Marine Generating Set and Projector (illustr.).—The Victor Telephone Mfg. Co.—A Successful Boiler Compound. 21
Davidson Vertical Triplex Pump (illustr.).—Scaling Down General Electric Stock 22
Housatonic Co.'s "Ideal" Shadeholder (illustr.).—Knapp Motor and Gordon Cell Outfits.—Swinging Ball Lightning Arresters.—Harrison Safety Boiler Works.—The Massachusetts Fan Co.—Zimdars & Hunt.—A Useful Data Sheet 23
I. P. Frink.—Advertisers' Hints.—Western Notes 24

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. JULY 14, 1898. No. 532.

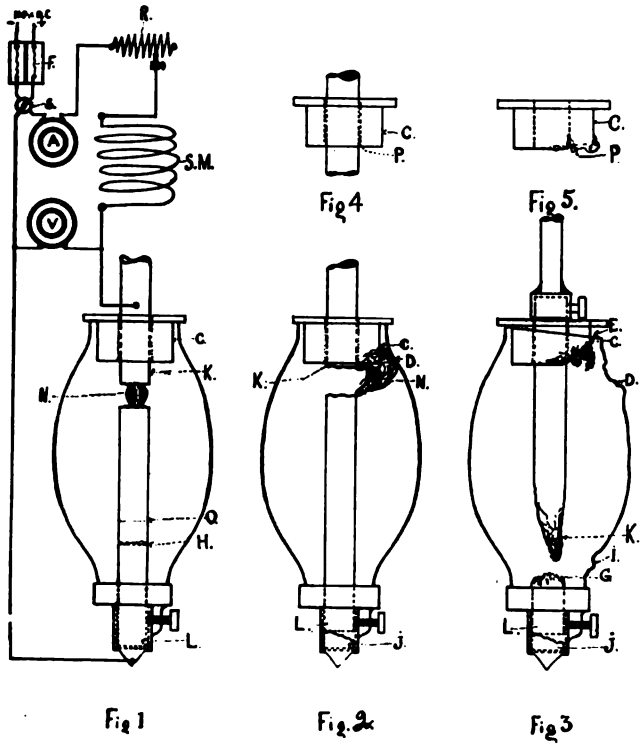
ELECTRIC LIGHTING.

A Few Interesting Pointers Concerning Enclosed Arc Lighting.

BY J. H. HALLBERG, E. E.

THE purpose of this article is to call attention to the fact, that much trouble is experienced in connection with enclosed arc lamps, that could be avoided if the men that sell, install, trim and take care of these lamps knew more about the operation of their mechanical and electrical details.

I do not excuse the manufacturers of these lamps, as they often place their goods on the market without being perfectly sure they come up to the claims they make for them. All readers who more thoroughly understand the designing and manufacturing of arc lamps and other electrical apparatus, well know that it is impossible to design them correctly without the practical experimenting. Some manufacturers succeed better than



others in overcoming the constantly arising troubles and ever-changing conditions under which these lamps are to operate.

The enthusiasm of the American designer and manufacturer is the cause of these goods being on the market before they are perfected. Everybody wants to be the first or next first in getting out new designs and current-saving lamps. One thing is sure, it is the best way to find out the weak points, and if it does not prove too expensive for the manufacturer and too troublesome for the customer, this kind of experimenting and testing enables the designer to produce a practical lamp that could not be obtained in any other way in so short a time, without an enormous expense.

Persons interested in the electric arc light business sometimes have ideas of their own which they wish to apply to a lamp sent for a test. This should never be done until the test is completed and you know how the lamp works with the adjustment set at the factory. You should not forget that when you overcome one trouble by a slight change you often run into much worse trouble and sometimes entirely disable the lamp. If you think your idea will bring you some money buy a lamp and experiment with it. If not, it would be much better for you and the manufacturers if you inform the latter of your idea and ask them to try it for you; it would save you trouble and time.

I will not argue the troubles that may show in any improperly designed lamp, as it would be of small benefit to the men who take care of the lamps. Sometimes much trouble will arise if the lamps are not adjusted for the proper voltage, amperage and alternations. In ordering, always state voltage, amperage, style of cover, finish, color of inner and outer globes, and, if for alternating current work, state alternations per minute; if for street railroad or power circuits state maximum, minimum and average voltage.

The following figures will show you how a properly designed enclosed arc lamp may be completely ruined by too heavy a flow of current at the arc, or by the arc being too close to the neck of the inner globe. This is the most frequent cause of trouble.

Let us now pay attention to Fig. 1. Here we have a diagram of a properly trimmed 5-ampere, enclosed arc lamp connected to a 110-volt, direct current lighting circuit. F is a double pole fuse block with 6-ampere fuses; S, double pole switch; A, amperemeter in series with the lamp; R, resistance in canopy of lamp, in series, showing clip connecting it at the proper place with S. M., the solenoid or magnet coil; C, gas cap or gas check to prevent inlet of air in the inner globe; K, upper carbon sliding freely through a hole in C; L, lower carbon, which is firmly held by thumbscrew in lower carbon holder, which is connected to the negative wire from switch; V is a voltmeter, which is connected to the upper and lower carbon and gives us the voltage at the arc, N.

If we now turn the switch, S, the lamp draws its arc, N, the top of which should always be one-half inch from the bottom of cap, C. We will then wait about ten minutes before taking our actual volt and ampere readings. It requires about ten to fifteen minutes for the current to heat the resistance and the solenoid, and it takes the arc about the same length of time to heat the carbons and consume the oxygen (air) in the inner globe, which should make good, air-tight joints at the the top with cap, C, and at the bottom with the lower carbon holder. If we now watch the ammeter, A, it will vary in a good practical lamp from 4¾ to 5¼ amperes. The voltmeter, V, should read about 78 to 80 volts. If V goes over 80 you can bring it down by moving the clip on the resistance to the right, so as to cut in more of it; if V is lower than 78, move the clip to the left. Never move the clip unless you know your line voltage is at the proper pressure and after you have watched the voltmeter for at least five minutes, as it may only be a momentary flash of the arc caused by impurity in the carbon.

We have now data for Fig. 1, as follows: Line, 110 volts direct current; A reads 5 amperes; V reads 80 volts.

The arc, N, is about ⅜ inch long and ½ inch at least from cap C. If the upper carbon is 12 inches by ½ inch, lower 5 inches by ½ inch solid highest grade carbon, and we let the lamp burn without interruption of the current, it should burn about 170 to 180 hours, and then cut itself out and leave the upper carbon in the position shown by line O, and the lower carbon at line H. If we now remove the inner globe, we will find that the dust accumulated on its inside will wash off easily in clean water. After cleaning the globe, we retrim the lamp, cutting the carbon stub left in the upper holder for the lower by cutting it to 5 inches. If the trimming is properly done we will obtain just as good a light and readings as during the first run; and if you clean the working parts of the lamp once or twice a year and always use highest grade carbons of correct sizes, and never use cracked or chipped inner globes, your lamps should last you a very long time. If we could always be sure the above details were followed out, everything would run along very smoothly, but this is impossible unless a set of very strict rules are laid out for the men who take care of these lamps, and they should thoroughly understand their working parts, especially the mechanical. I have found that much trouble is caused by defects in lamp mechanism, which in turn cause the coil, resistances, fuses, etc., to burn out. These mechanical defects may exist in the lamps themselves (often called their diseases), or may be

Digitized by Google

caused by improper packing, installation, trimming, etc.; or, after the lamp is hung properly, by the use of bad inner globes, by poor quality of the carbons, by carbons that are not of the right size, by excess voltage at the terminals of the lamp, or by dust accumulating, and in that way preventing the proper working of the mechanical details in the lamps.

If we again turn our attention to the accompanying figures we see in Fig. 1 a properly trimmed lamp with the arc and lower carbon in proper position, and it should burn 170 to 180 hours continually. Fig. 2 shows us an improperly trimmed lamp with its arc and lower carbon too high in the inner globe. Fig. 3 shows us the result of a slight oversight in the trimming.

Let us now retrim the lamp in Fig. 1, so as to bring the arc N in the position shown in Fig. 2. In this case you will notice how the lower carbon L was broken and a small stub J was stuck in the bottom of the carbon holder and through carelessness was not removed. This prevented the insertion of the lower carbon L, which, of course, brings the arc N very near the gas cap C, which is mostly made of metal and soon gets heated above the normal. If the arc should catch in the cup C, it would melt a portion of its metal. That causes a practical short circuit across the arc N, which now drops very much in resistance and allows 50 to 60 per cent. more current to pass through the coils, etc., unless the fuse blows, which seldom happens, as I find that most 5 ampere lamps are fused with 7 to 10 ampere fuses which sometimes carry 10 to 15 amperes. This metallic arc of very low resistance is inclined to flame, and being much above the normal length and heat, touches the neck of the inner globe, as shown in D Fig. 2. If the arc continued in this position it would strain the globe around the neck and sometimes melt the cap C and buckle the globe at D Fig. 3, which leaves the opening E. If we do not pay attention to the lamp and shut it off when this disastrous arc establishes itself, which is easily observed, as the arc has a greenish color and does not give much light, the lamp will, in most cases, be rendered useless. If the lamp should continue to burn, the inner globe will have a film of yellow dust on its inside which will shut off 50 to 75 per cent. of the light. The air will be admitted to the inner globe through the opening E, Fig. 3. This will allow the arc to consume the carbons in 25 to 50 hours. You will also notice how low the arc burned before it cut out. It buckled the globe at I, burned the upper carbon to a point K and the top of the lower carbon G is extremely low, so low in fact that its heat may ruin the lower carbon holder. Should we now have the voltmeter and ammeter connected to the lamp trimmed as Fig. 2, the following readings will be observed: amperes, 10 to 15; volts at the arc, 5 to 10.

As the lamp is only designed to stand 5 amperes, it seems natural that something should give out when 10 to 15 amperes are forced through it.

If we now proceed to examine a lamp which has been subjected to this rough usage, we may find in the worst cases something like the following: After removing the lamp cover and the outer globe, our attention is called to the inner globe, which is generally melted so badly as to be useless. The upper carbon sticks in its passage through the hole in cap C, as it has been roughened from the excessive arc heat, shown in P Fig. 5. If some kind of an insulating compound has been used on the solenoid or magnets it is generally found deposited all over the mechanism, making it sticky. The solenoid or magnet is in most cases burned out. The resistance is generally in a fair condition, but sometimes it has been heated to so high a degree that its own tension pulls it apart. If other insulation than porcelain, mica and lava is used, it will be found charred and useless. The worst trouble of all is, many people who handle the lamps are at a loss to know what caused this disaster. The best remedy in a case of this kind is to send the lamp to its manufacturers and get them to repair it. Should you feel inclined to do it yourself, a few suggestions here may not be out of place.

Remove all working parts from the lamp, soak them in benzine or similar fluid that will cut the insulating compound deposited on them; remove the resistance wire, solenoid and all charred insulation. Clean the lamp frame carefully so that no sticky substance will remain on it. Take a round file and file a hole P in the gas cap C Fig. 5, so that it will give easy passage for the upper carbon, as shown in Fig. 4. Now assemble the lamp. Put in new resistance wire or turn the old one around. This may be done in some makes of lamps as they supply more than necessary. Screw on the new solenoid. Put in new insulation where necessary, assemble all the working parts and take good care that all joints are clean and work freely. Be sure to clean the dash pot if the lamp has one. Never use oil on the bearings or glycerine on the dash pot, unless so instructed by the manufacturer of the lamp. Place the carbon in the upper holder and be sure the clutch is adjusted, so as to allow it free passage when the mechanism is at rest. Now lift up, or press down on the core in the solenoid and see if your clutch grips the carbon properly and allows it to be lifted as high as it should go. Place the carbon in the lower holder and take a new inner globe and place it on the lamp. Be sure all connections inside the lamp are made correctly and tight. Connect lamp in a circuit, carrying the same voltage as that on which lamp is to be operated, and proceed to adjust lamp by moving the clip on the resistance. The proper place for this clip is determined by a voltmeter, which is connected across the arc (that is one wire makes contact with the upper and the other with the lower carbon). The voltmeter reading should not be depended on unless the lamp has burned 10 to 15 minutes, and should then read according to line voltage as follows: Line—100 volts, arc voltage should not be over 75 volts; at 105 volts, about 78 volts; at 110 volts, 80 volts; at 115 volts, 82 volts; at 120 to 125 volts, 85 volts. The reason for this change of arc voltage is the necessity of a certain amount of pressure in the resistance that is required for the proper regulation of the lamp mechanism.

Sometimes people have asked me why they can't run their enclosed arc lamps on an 80 volt constant potential dynamo without resistance, which would save about 150 watts per lamp. I always tell them that as yet it cannot be done practically. It would require a very expensive lamp and it would be so delicate in its operation that the slightest abuse would prevent its proper operation.

After you have properly repaired, cleaned and tested the lamp, your next move will be to hang and connect the lamp in the circuit on which it is to be operated. Be sure your fuse for a 5 ampere lamp blows at about 6 and not over 7 amperes. Get your positive wire in its proper binding post. A very easy way to determine if your lamp is burning "right side up" or "upside down," is to let the lamp run about 5 minutes, then shut it off and see which carbon is the hottest. The upper carbon should have a red heat, when the lower carbon shows no such sign, if the lamp is properly connected. Should the lower carbon show more heat than the upper, reverse the connections leading to the lamp. The above suggestion in regard to proper connections only applies to lamps operated on direct current. When an alternating current lamp is used this precaution is not necessary.

Everybody who may read the above will surely see how little mistakes and oversights may cost the consumer and manufacturer a great deal of money and cause inconvenience to customers of electric light plants.

The Northern Electric Company of Baltimore, Md.

THIS company succeeded last October to the plant and business of the old United States Electric Power and Light Company, and is operated under the management of J. F. Morrison, who organized and managed both the other companies until they passed into the hands of outside capitalists.

Since the change in the management a new building of brick and iron has been erected. This was put up over the old wooden structure when the latter was removed, all the work having been done while the plant was in operation. The plant is devoted to commercial lighting and power, and is now running 500 arc lights of the Walker type, and 4,000 incandescent lights, with a large number of motors.

This is regarded as a creditable showing, as the new company started in October with only a few arc lights, no incandescents and no power motors. Among the recent contracts are 108 arc lights for a bicycle racing track, recently erected by the League of American Wheelmen, together with two pleasure resorts nearby.

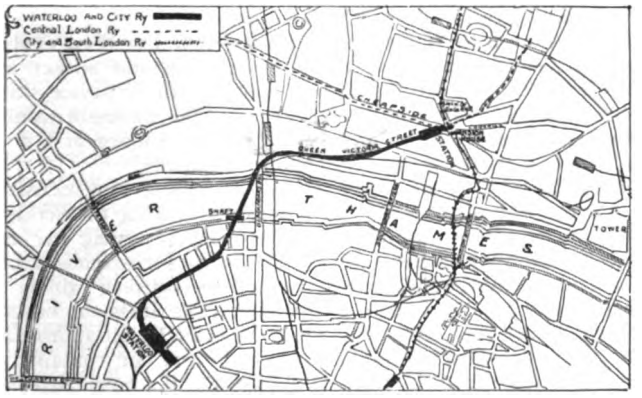
The original power equipment of this station consisted of two Wetherell-Corliss engines, one of 225, the other of 100 h. p., from which power is transmitted by belts to a countershaft, and from this, belts drive eight 50-light and three 100-light American Fort Wayne machines, and two 150 k. w. and one 360 k. w. Stanley alternators. The alternating current has a tension of 2,000

Digitized by Google

volts, while power for motors is supplied from 220-volt, direct current Walker dynamos. Recently there has been added an American Ball cross-compound engine of 360 h. p. This engine is one of the latest designs turned out from the Bound Brook Works of the American Ball Engine Company. It is provided with a self-oiling device, actuated by a small pump, by which the oil is delivered to the bearing in a jet or stream, governed in its oiling by the speed of the engine. Two additional engines, one of 450 h. p., and one of 360 h. p., are now under contract. There is also a new switchboard, Stanley-Pope design, which will be equipped with all the up-to-date appliances that may be required. The steam equipment of the station consists of six 100 h. p. tubular boilers and one 800 h. p. or the Sterling water tube type. The auxiliary steam equipment consists of two feed-water heaters, of 600 and 1,000 h. p. The fuel consists of George's Creek coal, which is delivered directly to the fireroom by the coal company.

The Waterloo and City Underground Electric Railway, London.

THE second underground electric railway constructed in London will shortly be in full working order, and the conditions of the journey from Waterloo station to the Bank of England will undergo a remarkable transformation. It is nearly seven years since the first electric underground line, the City and South London Railway, which we have illustrated and described on several occasions, was opened; and the improvement that has been effected in the meantime in undertakings of this character is very noticeable. The first line was largely experimental; the second, while it also may be so described in its

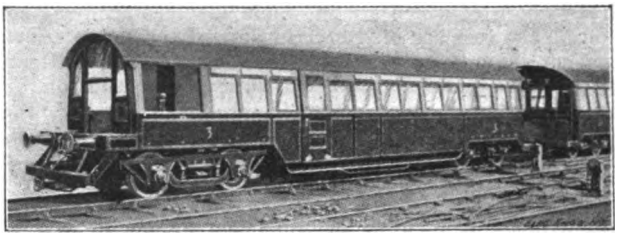


MAP SHOWING THE ROUTE OF THE WATERLOO AND CITY UNDERGROUND RAILWAY, LONDON, AND ITS CONNECTIONS WITH OTHER ELECTRIC UNDERGROUND RAILWAYS.

electrical equipment, has, as respects its other features, been carried out with the assurance bred of the success of the first line. The work was begun in June, 1894, and it was expected that the railway would be opened in 1897; but, considering the enormous alterations necessary in constructing the underground station and subways at the Bank, and other unforeseen difficulties, it is surprising that the delay has not been more protracted.

The Waterloo and City Railway is about one and a half miles in length. It consists of two tubes, one for trains passing in each direction, which are some 60 feet underground at the points furthest from the surface. The terminus at Waterloo is immediately below the station of the London and South Western Railway. That station being built on arches, readily permits of the structure beneath, and the difference in level is only about 38 feet, so that lifts are unnecessary. From several platforms steps and inclines lead down to the City lines, and the arrangements throughout appear to be conveniently planned. The lines of the electric railway terminate in a yard about 350 feet, where there are several sidings.

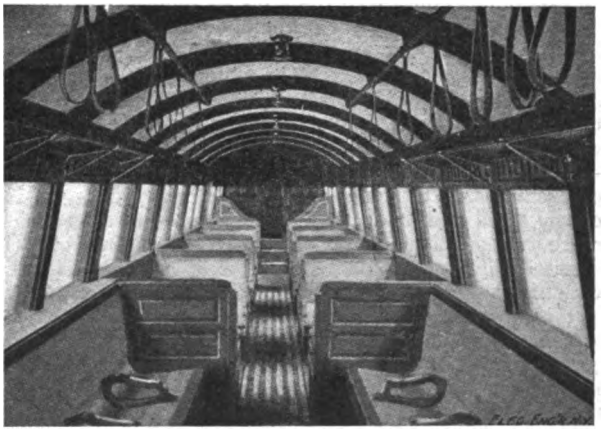
The generating station, a substantial brick structure, is adjacent to the siding on the west. The sidings are, of course, below the level of the street, as is the floor of the engine and boiler room. After arriving at the station the trains will simply be run on a few hundred feet and be shunted back to the up road in readiness for the return journey. The territory covered by the new railway is shown on the accompanying map. For some distance it runs under the District Railway and from 45 to 53 feet below it. The steepest gradients are 1 in 30, down, and 1 in 60, up. During the descent to the river the gradients



MOTOR CAR, WATERLOO AND CITY UNDERGROUND ELECTRIC RAILWAY, LONDON.

of the two tunnels differ, but at the shaft in the river they are on a level for 100 feet, and then rise 1 in 800 for 1,300 feet, and then 1 in 88 to the end of the station, close to the Mansion House. The platforms will be over 300 feet in length and 65 feet below the surface, to which hydraulic lifts will convey passengers.

The contract for the construction of the tunnels was let as a whole to Messrs. John Mowlem & Co., and they began the work by the construction of staging in the river. The staging was 325 feet long by 50 feet wide, connected by a foot bridge with the south bank of the river, but all material has been received and all excavation discharged by river boats. On the stage were engines and dynamos, air compressors and other machinery necessary in the prosecution of the work. It was the starting point for the tunnel shafts, which were driven in each direction. Air locks were required during a part of the work, but when these were no longer necessary, the haulage of excavated material was done by electric locomotives, made by Messrs. Siemens Bros. & Co., and especially designed by them for the work. They were small machines, receiving current from



INTERIOR OF MOTOR CAR, WATERLOO AND CITY UNDERGROUND RAILWAY, LONDON.

an over-running double trolley. The gauge of the line was 18 inches, and the locomotives were capable of hauling a load of 5 tons at a speed of 7 miles per hour.

The internal diameter of the tubes is 12 feet 3 inches, but near the Mansion House station they merge into one, and the diameter there is 23 feet. The tunnels are built up in sections, each section consisting of seven segments and a key, the section being 20 inches in length.

The method of electrical equipment received very careful attention on the part of the company, and the relative advantages

Digitized by Google

of the three-wire and three-phase systems were the subject of much discussion. Eventually the three-wire system was adopted at the suggestion of Prof. Kennedy, who was appointed electrical engineer, and prepared the specifications. Messrs. Siemens Bros. & Co. were given the contract for the engines, generators, motors, etc., and they have supplied three direct coupled units with generators of their two-pole type, giving 225 k. w. (500 to 550 volts) at 350 revolutions. The engines are three-crank horizontal compound machines, made by Messrs. G. E. Belliss & Co., of Birmingham. The boilers have been supplied by Davey, Paxman & Co., and are fitted with Vicar's mechanical stokers. All rolling stock has been made by Jackson & Sharp, of Wilmington, Del. It consists of otor and trail cars, both of which are shown in the accompanying illustrations. The cars are of American design, and the interior arrangement is simlar to that of cars on the New York Elevated Railroad. The motor and trail cars differ in construction. Externally the former much resemble the motor cars in use on the Budapest electric subways.

There is a compartment for the motorman at one end, while the remainder is designed for passengers. Entrance is by the platform at the end, and also by a side door opening directly on to the platform in the usual way. The interior of the passenger compartment of the motor car is shown in the illustration, and the general arrangement of the trail car is similar to it. A pair of steps at the end lead to a raised deck adjacent to the motorman's compartment, and there are seats here for passengers. A very simple but neat finish has been given to the cars, which are lined with oak and fitted with bronze trimmings. The only purely ornamental feature is a small machine-pressed oak beading, with a variation of the egg and dart pattern, above the windows. Only the car bodies apparently have been manufactured in America, the bogies having been constructed at the Eastleigh Works in England. We are indebted to "The Railway World," of London, for material for the above data and illustrations.

TELEPHONY AND TELEGRAPHY

The Evolution of the Telephone Line Signal.—II.

BY ARTHUR VAUGHN ABBOTT.

AT first it was considered desirable by lamp manufacturers to preserve a large volume in the bulb of the lamp in order to secure an adequate vacuum. To attain the desired compactness, the bulbs of the lamps were made smaller and longer. Gradually improvements in manufacture were sufficient to reduce the bulb of the lamp to a smaller diameter than that of the screw base, and it at once became apparent that some other method of securing the lamp in its socket would still further contribute to compactness. The next step was the construction of an exceedingly small bulb lamp, which was secured to a wooden base carrying two metal rings, to which the leading-in wires of the lamp were soldered. Whether the theory that the small-sized bulb militates against a sufficient vacuum is correct, or not, it has been impossible to definitely ascertain, but experience has shown that lamps having small bulbs were not so successful as large ones. In order to retain the compactness thereby attained, a long and slim bulb was made.

In this lamp an additional advantage was secured by placing the filament at the end of the glass opposite the seal. This end could be blown hemispherically and quite thin, thus allowing a maximum of light to be transmitted. Lamps of this description were chiefly made for four-volt circuits, the filament consisting of a very thin thread of carbon stretched between two platinum wires. These leading-in wires were fused through the sides of the bulb and soldered to two bits of thin copper forming the contact strips that were cemented to the glass tube. Some difficulty was experienced in the peeling off of these pieces, and, in addition, the amount of platinum in the leading-in wires was so great as to considerably increase the cost of such lamps. So, from motives of economy, a partial reversion toward earlier forms has taken place in the present standard lamp. The bulb is a glass tube about one-fourth of an inch in diameter and one and one-eigth inches long. For four-volt lamps a straight filament is used, but for all others a horseshoe shape. Only sufficient platinum is employed in the leading-in wire to pass through the glass, and in other respects the general details of manufacture correspond closely to the best practice in standard lamp construction. The base of the lamp is a bit of boxwood, so shaped as to readily enter the springs forming the socket, and arranged to prevent the lamp from turning as it is pushed into place. The earliest lamps were all designed for low voltage circuits, rarely more than four volts. Presently it became apparent that lamps of longer life, together with an economy in conducting circuits, could easily be attained by the use of higher voltages, and the next advance was secured by making lamps for 10 and 20 volts, while at present 12 and 24-volt lamps are standard.

When first used as signals, the lamps were placed in the local of a relay actuated by current passing over the line to which the signal was attached. In the early attempts the ordinary telegraph relay was employed, armed with extra heavy platinum contacts to prevent burning. It seemed possible to obviate the expense of installing and maintaining this relay by an appropriate lamp directly in series with the subscriber's line, so placed that the removal of the telephone from its hook should close the circuit and light the lamp. This experiment was first tried in the Chicago express office, and, on the whole, worked passably well, there being a comparatively small mortality of lamps due to short-circuits and other accidents. A continuation of this experiment was attempted in another office, but resulted disastrously, as the lamps were burned out so rapidly as to cause an excessive maintenance expense. The occasion of this failure is to be ascribed to a preponderance of ærial lines in the last case. A wind-cross occurring near the office on a long line would subject the lamp to an abnormal voltage and either injure or immediately destroy it. In an express office, where the lines were chiefly underground, little or no trouble was experienced from this cause, and in an office in St. Louis, similarly equipped with lamp line signals placed directly on the subscriber's line, the use of a very heavy filament lamp obviated the difficulty experienced with injury to lamps. But while economy in installation, due to the omission of the relay, is eminently desirable, present experience decidedly indicates that the relay is essential to the successful lamp signal.

For this purpose rather an interesting type has been evolved in an attempt to consolidate the relay, lamp and socket into a single piece of apparatus and at once obtain a device which should be absolutely dust-proof and free from trunnion trouble. This relay was developed largely with the assistance of Mr. M. A. Edson, of the Chicago Telephone Company.

The front end of the "lamp relay," as it is termed, consisted of a brass tube forming the lamp socket, carrying the screw at the bottom, supplied with round glass cap, carrying the subscriber's number. From the rear of the socket extends a core of soft iron surrounded by an iron tube, between which the winding space was obtained. A hemispherical brass cup covered the end of the iron tube, retained in its place by an appropriate set screw. The inside of this cap was hollowed out, containing a piece of soft iron, in the form of a frustrum of a cone, that constituted the armature. As this piece of apparatus was set horizontally the armature rested upon its edge in an unstable position, tending to settle backwards and rest against the back of the cap. The excitation of the windings magnetizes the core and attracting the armature, draws it up sharply. A thin platinum spring placed on the front face of the armature serves to make contact with a corresponding platinum point set in the centre of the core. As the core is insulated from everything but one lamp wire, while the other is connected to the cap, the excitation of the relay lights the lamp. By this device a relay was obtained, the moving parts of which were completely dust-proof. All trunnions or hinges were obviated and the armature merely resting upon a sharp edge secures a minimum amount of friction. Notwithstanding the compactness and completeness of this piece of apparatus, it has been found desirable to disassociate the relays and lamps, placing the relays in a case by themselves, away from the switchboard.

Probably the most gratifying feature in the evolution of the line signal has been the improvement in the life of miniature lamps. When the luminous signal was first proposed the question of cost of lamp renewals was at once raised. As each lamp was only illuminated for a few seconds at a time the service

Digitized by Google

seemed equivalent to constant flashing, and ominous prophecies were plenty as to the short life to be expected. It was confidently asserted that such small lamps would either immediately burn out, or else so rapidly become dim as to be valueless as signals. Some tests were immediately instituted in the hope of eliciting information on these points. There was no question but that the candle power of the lamps gradually declined, and photometric measurements showed that when a lamp failed to emit at least .05 candle power, it became of no value as a signal.

To determine the resistance to flashing, a number of lamps were connected in circuit with a clock pendulum and flashed at intervals one second for nearly a month, with no signs of serious injury. During this test the lamps were illuminated more than a million times, so it seemed certain that a reasonably long life could be expected. Experience has since shown this conclusion to be justified, for in the main office switchboard in Chicago, there are now lamps at work that have been in service for upwards of three years and seem still to be in fairly good condition. Observation has further shown that accidental injury rather than old age, is the cause of most lamp failures.

Much delay was experienced in obtaining the first lot of switchboard lamps, so on reception they were immediately placed in service without inspection. The rapid failure of a large number of these caused no small degree of consternation and it was determined to initiate a systematic inspection. As a result, all lamps are now examined: 1. Mechanically, to see if they will fit the sockets. 2. Electrically, to determine if they have the proper voltage and consume current within the specified limits. 3. Optically, to ascertain if they emit the required candle power and absorb the proper watts per candle. Also a certain number of lamps from each lot are placed on life test and burned to destruction.

Tests made show that in 1895 only 200 hours' life could be expected, while from the latest tests the 20-volt lamps show 2,400 hours' life before failure, and the 10-volt lamps show 2,500 hours, and are still burning, with indications of considerable additional life.

With sample lamps tested in 1897 the 4-volt lamps failed almost immediately, only yielding upwards of 50 hours. The 20-volt lamps, tested in 1897, gave upwards of 600 hours' life as an average. Nineteen lamps tested lasted over 1,900 hours and one lamp over 2,500 hours.

Results indicate a much greater irregularity for the 10-volt lamps. Some make a bad showing, only one lamp lasting over 40 hours; others are much better, indicating a life of 400 hours, but still are much below the life shown by the 20-volt lamps. A curve represents the results of tests upon 20 10-volt lamps recently manufactured. This curve is a straight line for 2,500 hours, showing that so far no failures have occurred, and from the appearance of the filament, it is reasonable to expect several hundred hours more life.

Some other curves taken illustrate strikingly the relation between life and candle power. As switchboard lamps are usually supplied by 10 cells of storage battery, it is impracticable to always maintain them at precisely a constant potential, for the pressure is likely to vary one or two volts from that of full charge to that of discharge, and regulating resistances are more expensive than decreased lamp life. Even at the highest pressure it is interesting to note that the lamps at present show a life of over 1,400 hours.

Lamp experts will at once infer that improved life is obtained by a lamp of low efficiency and will urge the cost of the current as an insuperable objection. The total cost of a luminous signal is evidently the cost of the lamp, plus the cost of current consumed during its life, and it is easy to show that this is a minimum when the cost of the energy consumed is equal to the cost of the lamp. Switchboard lamps now cost in the neighborhood of 45 cents each. With a life of say 2,000 hours, the cost of energy is about 60 cents, but it has been shown that accidental causes tend to reduce the actual life in the switchboard far below that shown by laboratory tests and it is doubtful if the average lamp lives for 1,200 hours. Unless accidental destruction can be greatly reduced below the present amount, the cost of the lamp is now considerably above the cost of energy during its life, and a still lower efficiency could profitably be employed, for it must be remembered that the thick, heavy filament in the low efficiency lamps is the best insurance against accidental injury. Theoretically, subscribers' line lamps should last 25 years; cord supervisory lamps from one to two years; trunk line lamps the same length of time, and pilot lamps from three to six months. Such a life as this has been obtained in the cord and pilot lamps, but it is doubtful if the theoretical limit for the line lamps will ever be closely approximated.

Even in the present probably only partially developed state of the luminous signal, nearly 20,000 subscribers are now served upon boards thus equipped, and switchboards for as many more are in process of construction. Already the adoption of this form of signal has materially modified the arrangement and design of switchboard apparatus, and has been so efficient a factor in the improvement of telephonic service that it is difficult to prophesy the end of its effect.

The Chesapeake and Potomac Telephone Company, Baltimore, Md.

BY C. B. FAIRCHILD.

TWO companies are in the telephone business in Baltimore. The Chesapeake & Potomac Telephone Company handles the bulk of the business, however, and were first in this field, the original company having been organized in 1878, to operate under the Bell patents. The Bell solid back instruments are used, and the lines are metallic and of hard-drawn copper wire. The territory covered by this company embraces all of the State of Maryland and District of Columbia, and part of West Virginia. The superintendent, Mr. Archibald Wilson, has been with the company since its organization, and was the first to introduce telephones in Baltimore, having early in 1878 established between his home and that of some of his neighbors what he now calls a play line, a large box telephone with magnets having been employed.

There are two main Baltimore exchanges located on the fifth and seventh floors of the building, which the company owns, on St. Paul street. The number of local subscribers is about 3,600. Eleven branch exchanges are located in different parts of the territory, and there are several private exchanges for the accommodation of railroad companies and other corporations that do a large private business. There are four copper metallic circuits between Baltimore and Washington, a distance of 40 miles, so that subscribers can get communication between the two cities with great facility. For ten years past the company has had connection with the long distance system of the American Telephone & Telegraph Co., the main line of which passes through Tuxedo, six or seven miles from the Baltimore exchange, where they now have an office exclusively for long distance business. By this means any local subscriber can talk directly with a person as far west as Omaha, east to Portland, Me. A metallic circuit is provided in all cases for long distance service. The subway lines occupy conduits of vitrified clay, and commodious and well built manholes are located at the street corners. The conduits also contain a return wire, put in by the telephone company to take care of the stray currents from the trolley lines, and thus prevent electrolytic action on the cable sheaths.

The demand for instruments is increasing rapidly, due to the inauguration of a message rate service, which has been recently adopted, and the system of regular and thorough inspection. This includes calling up each subscriber in the morning to see if the line is in working order, besides having each instrument inspected every 30 days by an expert, at which time the subscribers sign a statement that it is in good order. Batteries are renewed periodically. All complaints are turned over to the trouble department, are promptly investigated, and necessary repairs made, so that a subscriber is sure of getting a satisfactory service.

The schedule of rates has been adopted on the message basis, so that the subscriber pays in proportion to the number of calls he makes, and whether he is on a two, three or four party circuit. This is done to meet the requirements of small merchants, marketmen and others whose business will not warrant the payment of a regular yearly rate. The party lines are so arranged that the operator can call any instrument on the circuit without disturbing the other, by simply pressing a button. The price schedule for message rates is according to the accompanying table. No charge is made for incoming calls, and the rates apply to business places within one mile radius of the exchange, and to residences within two miles. An extra charge for each quarter of a mile beyond the limit is made of $10 per annum

Digitized by Google

for a special circuit; $6 for a two party circuit, and $5 for a three party circuit:

No. of Local Calls.	Special Circuit. Rates.	Two-Party Rates.	Three-Party Rates.	Extra Calls.
600	$66	$50	$42	8 cents.
700	74	57	49	7 "
800	81	63	55	6 "
900	87	68	60	5 "
1,000	92	72	64	5 "
1,200	100	80	70	5 "
1,400	106	86	76	5 "
1,600	112	92	82	5 "
1,800	118	98	88	5 "
2,000	124	104	94	5 "
3,000	150	...	...	5 "

As noted above the Baltimore exchanges occupy a building owned by the company, with suitable offices for superintendent, contract department, electrical and operating departments, while the fifth and seventh floors are occupied as operating rooms, in which 43 operators are employed, with a chief and two assistants, and a monitor operator. These rooms are in charge of Mr. Frank Boyd, chief operator, who has shown great skill in selecting, organizing and managing the force, thus securing an exceptionally fine and reliable class of operators. The switchboards are located on the sides of the rooms, and are designed for 38 operators.

The switchboard is composed of ten sections, and each section has three positions. In each section there are 2,700 jacks, representing 2,700 circuits. These are arranged in groups of 100 (5 strips of 20 each), and these hundreds are placed in four rows of six groups each and one row of three groups. The first group is known as 0, meaning all circuits from 0 to 99 are contained in this group. The next is the 100 group, and contains all lines numbered from 100 to 199; the next 200, and so on. On each section there are 300 annunciators, 100 to each position, and at each position sits an operator. All lines enter the switchboard at the first section, where a jack is looped into the circuit. It then passes to section 2, where another jack is looped in, and then in succession to the rest of the sections, on each of which the jack is introduced, and returns to an annunciator somewhere in the system.

The new board on the top floor has an addition in the form of a miniature lamp, which is lighted and extinguished by the movement of the annunciator. Whenever a call is registered by the drop opening, the lamp circuit is closed and the lamp burns. The moment the operator restores the annunciator to its normal position the circuit is broken and the lamp goes out. The lamp is on a level with the operator's eyes and is intended to warn her that someone is calling.

Each operator controls 100 circuits, 80 of which are classed in the unlimited service, and 20 in the limited. On a call coming from one of the latter, the operator is required to fill out a record ticket, noting the number of the instrument calling, the time in hours, minutes and seconds, and the number of the operator. These cards are collected each hour, and the tolls are charged up by a special clerk. Women operators are employed during the day, and until eight o'clock in the evening, when men come on for the night service, and remain until seven o'clock in the morning. The day operators are on duty nine and one-half hours with one-half hour for lunch, and fifteen minutes recess in forenoon and afternoon. The first shift comes on at seven o'clock in the morning, and others follow at half-past seven, at eight, half-past eight and ten o'clock. Thirteen men are employed on the night service, whose duty it is to watch both boards and answer such calls as may come in. The wages paid to the women operators range from $5.25 to $9 per week, depending upon individual skill and length of time they have been in the service of the company. The force is divided into five grades, known as A, B, C, D and E, and great care is exercised in selecting and training the applicants for their positions. Applicants have to come well recommended, and must be reasonably strong and steady of nerve. One-third of the applicants fail to meet the requirements, and never become what is known as skilled operators. This is due to several causes, such as defective eyesight or hearing, but chiefly to lack of that particular deftness which is required. Although the service is considered wearing, the nervous strain being very great, a few operators in this exchange have been in the company's employ for 18 years. In breaking in new operators, they are first stationed behind a regular operator, with ear receiver in position, so that they can hear all the calls, and watch the movements of the operator. Then, when business is slack, they are given a seat at the board, and the regular operator in turn watches and instructs them in their duty. Applicants receive no pay while under instructions, and not until they are turned in as substitutes. The switchboard is so arranged that the operator can stand up or sit down as she may choose, but the rules require that each one speak in a low tone. They are not allowed to communicate with each other, nor in any case to give information to a subscriber, not even their own names. Should a subscriber wish to make a complaint against an operator and ask for her name, she replies: "I have no name, but my number is so and so." Every precaution is exercised to prevent a subscriber from learning the name of any particular operator.

Once a month a record is made of the number of calls received in a day, when an average is ascertained for each operator per hour, and should it be found that some of them have an excess of calls the circuits are re-distributed to make the work as uniform as possible. The calls usually number about 10 per day for each subscriber, in which case, 3,200 subscribers, the number on the main board, the average number of calls answered per hour per operator would be 93 and the maximum 181.

A monitor operator is employed who is stationed at a separate board, which can be connected with any panel of the main switchboard. It is the duty of this monitor to record the work done by any particular operator. The record shows the time of the call in hours, minutes and seconds, the time the operator answers, the time when connection is secured, and when the circuit is rung off. By studying this record the managing operator is able to judge whether the girls are prompt in answering calls, or if they are indulging in irrelevant conversation with a subscriber.

Visitors are admitted to the operating room on a pass from the superintendent or other official, but in no case are they allowed to communicate with the employés, nor are the employés allowed to receive notes or mail matter at the exchange. In very urgent cases, when a message comes from the operator's home, the chief operator may allow her to receive it.

Each operating floor is provided with a comfortable dressing room for use by the employés, with toilet facilities, and there is a room set apart as a lunch room with tables, where the girls can meet and partake of their lunches. No provisions are provided by the company, but a messenger boy is employed who comes in just before the noon hour and takes such orders for lunches as may be given him, which are filled at a neighboring restaurant. The following are extracts from the code of rules, copies of which are posted in the dressing room, and will indicate how rigid and thorough is the matter of discipline. This is deemed necessary, not only for the protection of the company to secure efficient service, but also to protect the operators from officious attention from undesirable parties:

RULES GOVERNING OPERATORS.

Operators must report punctually at the hours designated by the chief operator.

Operators must be courteous, under all circumstances, to subscribers and to each other.

Operators must not leave the switchboard without permission.

Operators are forbidden to sharpen pencils, manicure finger nails, to eat or read while at the switchboard.

Operators, before entering the operating room, must thoroughly brush their clothing and shoes.

Scarring or marking the switchboard will not be tolerated, and operators are cautioned against the habit.

Operators must enter and leave the operating room with the least commotion; every movement of the operator should be made so as to avoid as much noise as possible.

Operators must not notify each other that they are being called for over the wire; always inform the chief operator when an operator is asked for.

Operators are forbidden to give their names to the public; they must be known by number, never by name.

Operators must cultivate a low tone of voice. Answering calls in a loud voice will not be permitted.

Operators are forbidden to call out "Hello" or "Well," when answering calls; they must use the words, "What number."

Operators must not throw down the cams; they must be pushed down.

Operators must insert and remove the connecting cords by

Digitized by Google

grasping the plug only; they must never push or pull on the cord.

Operators must leave the circuit as soon as the connection is fully established; listening to connections on the wire is strictly prohibited.

Operators must be careful not to call in on connections while the parties are talking; wait five seconds before calling in.

Signals must be rung out clearly and distinctly, making a distinct pause before repeating the signal. This is imperative.

An operator's sole duty is to answer calls and make connections as promptly as possible, and operators are forbidden to do aught else except by permission of chief operator.

Operators who fail to report for duty on time will lose the day.

When operators are unavoidably absent they must report the cause to chief operator before eight a. m.; failure to do so will be cause for suspension.

Operators who are off duty must report before one o'clock p. m. the day before they expect to return, otherwise their places will be filled.

Operators are forbidden to take messages for each other; all messages for operators must go through chief operator.

Operators must keep posted as to daily orders on bulletin board. Ignorance of orders will not be accepted as an excuse.

Operators will be held responsible for the condition of lines, instruments and switchboard under their care; if they are not in good condition, report them to chief operator daily if necessary.

Operators are reminded that loud and boisterous conduct is not genteel, and they are, therefore, expected to preserve a proper decorum in all parts of the building.

All information to subscribers, etc., must be given from chief operator's desk. Operators must under no consideration give information to non-employés.

Operators will not be allowed to receive mail, visitors or packages while on duty.

No excuse will be accepted for failure to report for duty on Sundays or holidays. Violation of this rule is sufficient cause for suspension

Conversations over our wires are inviolable. Operators, therefore, must under no circumstances listen on the wires. To repeat conversations that have been overheard is sufficient cause for dismissal.

Operators when on duty are not allowed to leave the building without permission from chief operator or his assistants.

Practical Features of Telephone Work.—XVII.

BY A. E. DOBBS.

THE RECEIVER.

TELEPHONE receivers have not departed greatly from the standard Bell type, except that there is quite a difference in the quality of the material of which they are made. The best quality of steel for example will hold its magnetism for a long period of years; while I have run across some which were worthless in a few months.

I know of one manufacturer who uses steel that costs about 80 cents a pound for his receivers. It is unnecessary to say that his receivers are not sold for 50 cents apiece, and he has customers who have an idea that first cost isn't everything, and that people who buy instruments of him do not have to replace them in a year or so. Good electrical instruments require first-class workmanship and first-class materials, which recalls the advice of Dr. F. B. Crocker in regard to dynamos that "a poorly finished machine is apt to be very inefficient," or something to that effect, possibly because the manufacturer who uses first-class material and good workmen, will also spend the slight amount necessary to give it a good finish.

There is a tendency now among many manufacturers to use receivers of the bipolar type, and some of the latest put out by the Bell company are of this pattern for use in connection with their long distance instruments.

There is also a disposition among some of them, to make the case partly of metal. I do not think this is a good idea for the reason that the person using it is liable to shocks during a storm and this evil is by no means imaginary, as any experienced operator can certify. It is useless to caution people against using a telephone during a thunder storm, for an exchange which has been quiet all day may suddenly receive a large number of calls upon the approach of a storm, and it is precisely in such emergencies as this that the telephone proves its convenience, and with the many protective devices at our command, there is no need of shutting down an exchange during a storm, or exposing patrons to disagreeable shocks. An exchange should always be ready for business, and every safeguard provided to inspire public confidence. Let, for instance, some newspaper publish an account of a person killed, or shocked, while using a telephone. Hundreds of people read that item and thereafter they cannot be persuaded that a telephone does not "draw lightning."

One company in Cleveland, O., has gone to the other extreme and constructed a receiver in which even the cord tips are covered by the hard rubber case and no metal of any kind is outside; the receiver is of the bipolar type; and taken altogether it is as good as any I have ever seen.

The present practice is generally, to wind the receivers to a resistance of from 75 to 80 ohms, though one or two companies wind them as high as 175 ohms, which gives them a very powerful action, but they have to use a very heavy diaphragm, so that I really cannot see what is gained by it. Besides, as the receiver is connected in series with the line, it seems to me that the extra number of turns and greatly increased resistance and self-induction are a detriment, but it may be that the extra power thus gained will more than offset this feature.

I wonder if anyone has ever tried a receiver wound to 1,000 ohms and bridged across the line terminals?

INSTRUMENT SPECIFICATIONS.

I.—WIRING.

The wiring to be as much as possible in plain sight, and all of it readily accessible, and the wiring of the generator box and transmitter should be so arranged, that they can be readily taken apart for inspection and repairs.

Contacts between different parts of the instrument, as between the transmitter and magneto box, must be made through binding posts with machine threads and screws so that they can be readily disconnected; and contacts made under wood screws and washers, will not be approved unless such contacts are never likely to be disturbed and in addition are soldered.

No wires to go on the back of the backboard except the two leading from the battery to the switch and induction coil.

Induction coils and other parts must be so placed as to be readily accessible for inspection and repairs.

The induction coil must not be placed in the base of the transmitter arm or so placed that the entire transmitter would have to be disconnected in order to get at it, as these coils frequently get out of order.

Wiring contacts in the bell box and transmitter should be soldered as far as practicable, especially those in contact with the binding screws, leaving the connecting wires only to be brought under the screw.

No wires in the box to be coiled or "pig-tailed," except those connecting wires which are liable to be disconnected for tests, etc.

II.—MISCELLANEOUS.

The switch must have firm rubbing contacts, and preference will be given to those having platinum at such contacts.

The ringing coils should have a resistance of 250 ohms and must be so connected to the switch as to be entirely cut out, or short circuited, when the hook is up.

The generator—for ordinary exchange instruments—should ring clearly through a non-inductive resistance of 10,000 ohms, and the armature should preferably be "built up" of laminated plates.

III.—TRANSMITTERS.

Transmitters should be of the Hunning type and constructed as follows:

The disk to have a free swinging surface of at least 3 inches.

The resistance to be as nearly as possible from 15 to 18 ohms. Where granulated carbon presses against the disc, the area of contact not to exceed a square or circular space of ¾-inch in diameter. This also applies to transmitters of the "ball" type.

Any screws used to hold the carbon block to the arm should be insulated from the granules, unless specially intended to transmit part of the current; but it is better to have the current pass from the disk through the granules and to the plate directly, without going through any other conductor than the carbon, and an exposed screw in the base of the carbon block has a tendency to make the transmitter uncertain in its action.

The carbon disc should be electroplated on the front side

Digitized by Google

and contact with the battery made by means of a fine wire soldered thereto.

The induction coil to be four inches in length, and the iron core to consist of a bundle of fine, soft iron wires, laid longitudinally, not to exceed five inches in diameter, the iron wires not to be larger than 22 B. & S. in size.

The primary coil to be wound to a resistance of 1.5 ohms, and the secondary to 225 ohms, the winding to be as nearly uniform as possible, the difference between any two coils not to exceed 4 per cent.

(The requirements as to the secondary winding may be varied according to circumstances, but whatever winding is decided upon, make all the others conform to it).

There should also be a spring washer in the hinge of the arm, to insure a reliable battery contact at this point. (The author has traced a great deal of trouble in the battery circuit to this hinge).

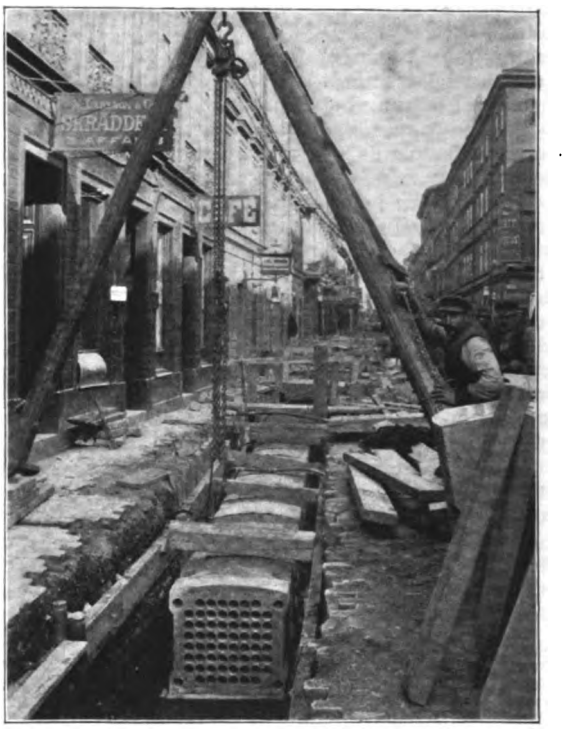
To get good results the battery used with this transmitter should deliver .2 of an ampere through the transmitter, switch and coil.

Overhead and Underground Telephone Work, Stockholm, Sweden.

ONE of the most interesting telephone cities in Europe, at least one to which a large amount of attention has been drawn, because of the alleged cheapness of the rates, is Stockholm. We have from time to time referred to the work in that city. and one of our articles illustrated and described the terrible damage done by a wind and snowstorm which broke down the huge roof structures for carrying wires and also leveled the suburban pole lines for miles. The result was a serious and prolonged interruption of service, and the determination of the telephone company to imitate American telephone companies by putting its wires underground. The work is now being proceeded with, and we illustrate one of the large concrete subways now being laid. These subways are made in sections of various sizes and number of ducts, from main lines with 60 and 76 ducts,

REPAIRING OVERHEAD TELEPHONE LINES, STOCKHOLM, SWEDEN.

down to branches and minor lines with tubes of only 7 ducts. By way of contrast we show the Stockhold method of inspecting and repairing overhead telephone lines, involving the use of a traveling car which crosses the lines over the roof tops and streets and thus enables close inspection to be made of all the conductors. The expense involved in laying the underground



LAYING TELEPHONE SUBWAYS, STOCKHOLM, SWEDEN.

subways is very heavy, and naturally adds greatly to the fixed charges in the operation of the telephone system.

The New Veeder Cyclometer Factory, Hartford, Conn., Electrically Operated.

WE illustrate herewith a novel and interesting machine shop designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., for the Veeder Manufacturing Company, of Hartford, Conn., who are noted for the excellence of the Veeder cyclometer, which is one of the best instruments made for recording distances traversed by bicycles. The mechanism of these cyclometers is very fine, and in the different processes of manufacture it requires the best of light in carrying on the various operations. The business of the Veeder Manufacturing Company being largely on the increase, they decided to build an entirely new plant, and the illustrations herewith show their new machine shop, both externally and internally.

The first illustration shows the exterior of the building, which is of a somewhat novel construction. The supporting framework is entirely of steel, the greater portion of the construction being steel and glass. It is three stories in height, the exterior presenting a very ornamental appearance from the unique character of the construction. It is 30 feet in width, 110 feet in length, the three floors giving nearly 10,000 square feet of floor surface, every inch of which, owing to the well-diffused light in the interior of the building, can be occupied for manufacturing purposes.

The interior is heated by hot air forced into the interior of the building from an adjoining boiler room by means of ducts located and made a part of the supporting columns of the building. This peculiar feature of the building was designed by C. H. Veeder, the president of the company, and adopted by the Berlin Iron Bridge Company in their design. Particular notice is

Digitized by Google

called to the sides of the building, which are made almost entirely of glass, but arranged in sections so that they can be easily opened and closed, thus securing plenty of fresh air. A great many people have an idea if the sides of a building are made of glass that the interior in warm weather will be insufferably hot, the same as a greenhouse. The facts of the case are exactly opposite. Owing to the superior ventilation secured by means of every other panel of glass swinging on a centre pivot perfect ventilation may be secured, and thus instead of being ex-

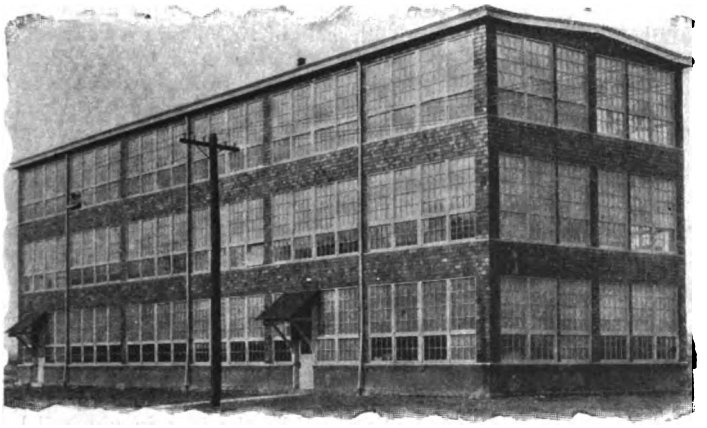


FIG. 1.

ceedingly hot in warm weather it is extraordinarily cool, and pure, clean air from the outside is furnished for the workmen.

Fig. 2 shows the interior of the upper floor of the building. This floor is entirely clear of columns, the roof trusses being of sufficient capacity to support not only the roof loads, but also to carry shafting, pulleys, hangers, etc. Particular attention is again called to the lighting of the interior of this portion of the building. A large amount of glass admits and diffuses the light so thoroughly in and through the interior of the building that the very fine work of the Veeder cyclometers can be carried on in the centre of the building as well as on the outside. The building is a credit to the designers—the Berlin Iron Bridge Company—to whom we are indebted for the illustration.

The current both for power and lighting is obtained from the local Electric Light and Power Company at the pressure of 220 volts, two-phase. The 110-volt lamps are distributed by the

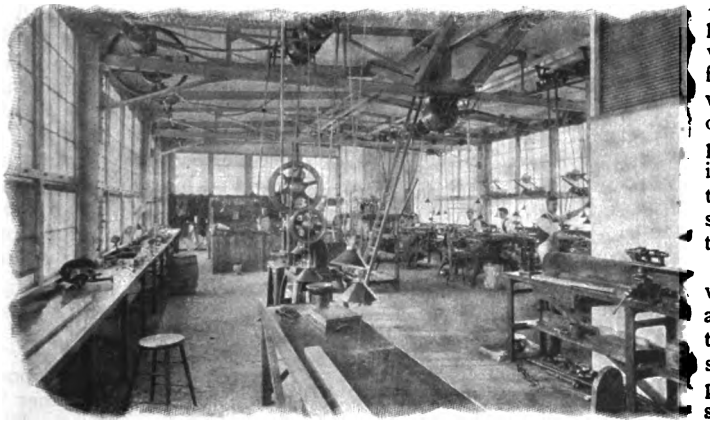


FIG. 2.

ordinary three-wire system, the numbers on each phase being about equal.

Power is furnished from General Electric two-phase induction motors. A 5 h. p. specially wound motor is used to run the elevator, the motor being directly belted to the hoisting mechanism and reversed by a special switch. In order to avoid excessive currents in the armature winding when starting, the end connections in the armature winding are made of high resistance metal. Some trouble was found at first on account of the excessive momentum of the armature, but a flange pulley was placed on the armature shaft and the belt allowed to run sufficiently loose that the belt can slip on the armature pulley when the hoisting mechanism is stopped quickly. This arrangement has been in use several months and gives no trouble.

EDUCATIONAL

Work of The Electrical Engineer Institute of Correspondence Instruction.

IT is exceedingly gratifying to note the success which has attended the conscientious efforts of The Electrical Engineer Institute of Correspondence Instruction in its attempt to furnish to the profession of electrical engineering absolutely reliable and trustworthy instruction.

Since the organization of this Institute in the early part of the present year, every State and Territory of our country, as well as many foreign countries, has furnished its quota of students, who have hailed with many a kind word of appreciation, the advent of the system which is rapidly proving to be almost ideal in its treatment of engineering subjects, and particularly those involving the manifold applications of electricity.

No doubt much of this success must be attributed to the standard set by the Institute which, we feel safe in saying, cannot be surpassed, since such eminent authorities as Professor Francis B. Crocker, of Columbia University; Charles F. Scott, the Chief Electrician of the Westinghouse Electric and Manufacturing Company; Elmer G. Willyoung, the well known electrical instrument expert; William Maver, Jr., the celebrated authority on telegraphy; Thorburn Reid, the well known designer of electrical machinery, and many others are included among those who have prepared papers for the courses of the Institute.

The student is thus assured of a course of instruction, the like of which even some of the universities of the country would find it impossible to supply him with. This fact has found keen realization in the electrical engineering profession, and is exemplified on the rolls of the Institute in a manner strikingly characteristic of the ambition and ardor existing among those engaged in the profession and trade. Many a man whose attainments stand unquestioned in the profession has found it advantageous to enroll as a student, thus enabling him to refresh his mind on subjects long forgotten, as well as to bring himself fully up to date in the latest developments and practical applications of his profession.

Students and others who have investigated the methods of the Institute and examined its series of instruction papers have expressed their complete satisfaction with its methods and its work. The Institute has in this manner gained a large circle of friends almost immediately, and this circle seems to be ever widening. Many manufacturers of electrical apparatus have recognized the value of these courses of instruction to their employés and have consequently afforded the Institute every facility in their power so that its representatives might present to their employés the methods of the Institute. As a consequence students have been enrolled in most of these manufacturing establishments, and the list is growing daily.

It is most gratifying to note, however, that not alone is the workman and apprentice enrolling, but the employer himself, as well as his immediate subordinates, appreciate the opportunity offered them and in many establishments therefore the several departments of office, storeroom, machine shop and power house have contributed students to the rolls of the Institute.

We have no hesitation in prophesying for The Electrical Engineer Institute of Correspondence Instruction a continued and growing usefulness, and can assure all prospective students that should they intrust their electrical education to the Institute their needs will be carefully studied and their interests zealously guarded.

In connection with the work of the Institute, mention should not be omitted of the beautiful, artistic and interesting book of information, entitled "Can I Become an Electrical Engineer," which is sent free upon request, and which contains one of the most complete and perfect portrait collections of the prominent scientists and engineers who have succeeded in making the profession of electrical engineering what it is to-day. We cannot too strongly urge anyone at all interested in electricity to apply for this beautiful book at the home offices of the Institue, 120 Liberty street, New York.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1888.*]

Vol. XXVI. NEW YORK, JULY 14, 1898. No. 532.

Sault Ste. Marie as an Electrical Centre.

IT has long since been demonstrated that the wealth of modern nations consists largely in the facility and low cost of generating power; in other words, given equal skill and enterprise that nation must have the advantage which is so conditioned that the cost of generating power is lower than that of its competitors. When to this great advantage is added an abundance of the natural resources the final winners in the race of commerce can be readily picked out. It was therefore an object lesson of the most pronounced kind that was enjoyed by those who participated in the recent floating meeting of the Northwestern Electrical Association on the Great Lakes. Everywhere they were brought face to face with the possibilities, indeed the probabilities, that this region is destined to enormous commercial and manufacturing expansion, first owing to the contiguity of raw natural products, and again to the proximity of sources of power to convert these products into marketable shape—the combination of resources as well as the power available being of a magnitude undoubtedly without parallel on the face of the globe. It is as yet too early to predict just where will be located the centre of commerce on the lakes. It goes without saying that the great metropolis of the future will grow up in close proximity to one of the great waterfalls or rapids. Niagara Falls has made a good start; Duluth and West Superior, located at the head of Lake Superior, will some day make available the power of the St. Louis River; Massena, N. Y., on the St. Lawrence, will also be at work electrically on a large scale within a comparatively short time. All these locations have claims to pre-eminence, but it is the claims of another of these favored localities that we deem it appropriate to dwell on more particularly here, and that is Sault Ste. Marie. It is here that Lake Superior, the greatest of the chain of lakes, overflows into its neighbor, Lake Michigan, and though the fall is only twenty feet, yet the enormous volume of the overflow makes available hundreds of thousands of horse power.

What the future has in store for this locality was most lucidly and entertainingly brought out in the address delivered by Mr. F. H. Clergue, of Ste. Marie, who justified the citing of himself as an authority by stating that every prediction he had thus far made regarding the Sault has been realized. The power available at this place being granted, it remained for Mr. Clergue only to show in what manner it is to be utilized, and in this he certainly succeeded in marshalling an array of facts which it would be difficult to controvert. To begin with, it was pointed out that the Sault Ste. Marie locks constituted the threshold to the most important storehouse of national wealth on the face of the globe. The wheat area tributary to Lake Superior, including that in British Columbia, exceeds all of the wheat area in the world beside, while at the same time the quality of the wheat grown is unsurpassed. Every ounce of that wheat, according to Mr. Clergue, must come through the Sault Canal. But instead of passing by it in the ships' holds it would soon be ground into flour at that point, for nowhere else was power to be had at less cost. He predicted, in fact, that within five years from now the amount of wheat ground at the Sault would reach 25,000 barrels of flour per day.

Turning to the products of the forest, Mr. Clergue pointed to the still unbroken wilderness, the outskirts of which were visible from the Sault, and which stretches northward for a thousand miles to Hudson's Bay, a wilderness of virgin forests containing all sorts of valuable woods, some of which have become almost if not quite exhausted on this side of the border. All this would come to the Sault to be sawed into lumber, or converted into wood pulp, the latter industry having already secured a splendid foothold.

But what will perhaps be of special interest to the electrical fraternity are Mr. Clergue's statements as to the direct applications of the current to the reduction of metals from their ores, to the production of calcium carbide, and to electrolytic purposes. The most strikingly suggestive of the facts brought out is that 20,000 h. p. of electrical energy is to be installed at once to operate electrical furnaces for the production of nickel steel, the entire product having been contracted for by the great German gun and armor making firm of Friedrich Krupp & Co., of Essen. The nickel ore is obtained in Canada at a distance of about 150 miles from the Sault, while the iron in unparalleled purity and abundance is within a distance of 200 miles. The proximity of the ore supply to the source of power and the improved methods adopted for obtaining the alloy have made it possible to sell it at a large profit at the current market prices. As to carbide, the existing works of the Union Carbide Co., at the Sault, will be but a bagatelle compared with those to be created in the near future. We note the giving out this week of an order for twenty 500 h. p. Walker generators to supply the new carbide works to be erected on the American side.

But these are not all of the direct applications of the Sault power to the extraction of wealth from its neighboring localities and their product. We are told indeed that negotiations are now in progress according to which the copper from the Calumet and Hecla mines will be subjected to electrolytic treatment for the extraction of the silver contained in them, 10,000 h. p. of electrical generators being about to be installed for that purpose alone.

If to the facts above enumerated it be added that an iron ship can be built on Lake Superior cheaper than one of wood at Bath, Me., the impetus which this industry will receive in the region under discussion must be apparent. Taking into account only the actual facts and contracts entered into for immediate power utilization at the Sault, that alone would suffice to make the future of any community one of stability. One is forced to the conviction, indeed, that Mr. Clergue, enthusiastic advocate though he be, is not over sanguine and that his prophecies stand an excellent chance of being realized. Certain it is that Sault Ste. Marie is fortunate in having among its workers one so confident of success and withal one so competent as an organizer.

Signs of the Trolley Times.

THE extreme degree of the change from the original opposition to trolley roads is shown in a remarkable manner by the proceedings of a recent large political convention in Vermont, when a resolution was passed inviting the State legislative members to vote "for all bills that tend to establish new electric railroads leading to the now more inaccessible localities so rich in agricultural products, lumber and minerals, passing through scenery unsurpassed in this State, which we believe will tend to the building up and increasing of the material prosperity of the country." This is the right way to regard the new agency, and we could only wish that every political convention were as intelligent and liberal in its attitude toward new enterprises and the corporations pushing such necessary schemes forward. We doubt if a single instance can be pointed to in which the rural trolley has been other than a distinct boon and benefit anywhere in the United States.

The application of the trolley to these rural and back regions has, in truth, become one of the great social and technical ques-

Digitized by Google

tions. We are interested to note that at the recent meeting of the Canadian Electrical Association serious attention was drawn to a plan for the standardization of farm wagons in such a way that they could be taken aboard bodily by trolley trucks and thus hauled to and from market. At first blush, this looks like a rather wild project, but we confess we can see no good reason why some such plan should not be carried out in every rural region now tapped by a trolley service. The lessening of the cost for haulage and of loss from spoilage of produce would be enormous; the trolley would open up new country and a new source of income; the rates would be so low as to encourage the development of new lines of cultivation, and the ties between town and country would be closer knit than ever. These things will come, and must come soon, with electricity as the prime factor in their coming.

Progress in Electro-Metallurgy.

THE rate of development in the field of electro-metallurgy is not fully appreciated by the public, and Mr. Andreoli has done well to summarize it recently in a review of the work done during the past year. Much of the survey is, of course, familiar, but there are many features of novel or special interest. The electro-metallurgy of lead finds its champion in Dr. Tommasi, who has succeeded admirably in the desilverizing of lead, a process which can be advantageously applied to the treatment of poor lead ores. We all know of the enormous development of the electrolytic refining of copper in the United States, which has no parallel in the world; and the refining of metal by a similar process at the expense of only one electrical horse power per hour for the refinement of one pound of metal. One of the greatest steps forward in the electrolytic production of chlorine and caustic soda has been made by the Castner-Kellner Alkali Company, who are erecting large works both in this country and England, and the Parent Electrolytic Company, which owns the new Hargreaves-Bird process, and is starting an important installation for the manufacture of bleaching powder and chlorates. Of the Haycraft process of gold reduction only good reports have reached us, while by means of the Cassel process, gold has been successfully extracted from telluride ores. The enormous production of aluminum during the past year has been unprecedented and is largely due to improvements and cheapening of the methods employed for its production. Still fresh in our minds is the remarkable success achieved by Mr. Cowper-Coles in the electro-deposition of zinc on a commercial scale and his method for making parabolic mirrors. A distinct advance has been made in electro-metallurgy by the employment of electrolytic precipitation. This process is governed by an entirely different set of laws from those governing the electro-deposition of metals, and it has already been successfully employed in the precipitation of gold, according to Mr. Andreoli, in the Engineering and Mining Journal.

So much for the past. A glimpse into the future reveals great possibilities for the employment of both the alternating and high tension currents for electro-chemical purposes. Sir William Crookes has already employed alternating currents for the treatment of auriferous ores, others have followed in new directions and already numerous experiments are being made to test the availability of high tension currents for electro-deposition.

MARRIED

Brayton—Wait.

Mr. William S. Brayton, of the New York office of the General Electric Company was married May 3 last to Miss Alice Wait, of Ithaca. Mr. Brayton is a graduate of Cornell, and passed through the works at Schenectady before assuming his duties at the New York office. He is a favorite among all his associates, who testified their appreciation by presenting him with a handsome souvenir of their esteem. We offer our congratulations to the happy couple.

SOCIETY & CLUB NOTES

American Institute of Electrical Engineers.

At the meeting of the Executive Committee, June 24, Mr. C. O. Mailloux was elected a vice-president of the Institute to fill the vacancy caused by the recent election of Dr. A. E. Kennelly to the presidency. Mr. Robert N. Baylis was also appointed a member of the Board of Examiners, succeeding the late Dr. Chas. E. Emery.

The following associate members were elected: Walter Cummings Allen, Inspector of Electric Lighting, Government of District of Columbia, District Building, Washington, D. C.; Albert H. Armstrong, Electrical Engineer, General Electric Co., Schenectady, N. Y.; Geo. A. Damon, with B. J. Arnold, Electrical Engineer, 1541 Marquette Building, Chicago, Ill.; Frank H. Dexter, student Cornell University, residence, 51 Huestis street, Ithaca, N. Y.; P. M. Downing, Supt. Electrical Dept. Blue Lakes Water Co., Blue Lakes City via Jackson, Cal.; Joseph Lyons, Patent Solicitor, with Gustav Bissing, 908 G. street, Washington, D. C.

The following associate members were transferred to membership: Alfred A. Thresher, Electrical Engineer and Proprietor, Thresher Electric Co., Dayton, O.; William B. Jackson, New York and Staten Island Electric Co., West New Brighton, N. Y.; Paul M. Lincoln, Electrical Superintendent Cataract Construction Co., Niagara Falls, N. Y.; Thorburn Reid, Consulting Electrical Engineer, 120 Liberty street, New York City; Philip Green Gossler, Electrical Engineer, Royal Electric Co., Montreal, P. Q.; Theodore E. Theberath, Pacific Coast Engineer, Stanley Electric Co., San Francisco, Cal.; Frederick M. Pedersen, Assistant Electrical Engineer, Crocker-Wheeler Electric Co., New York City; Will K. Dunlap, Electrical Engineer, Westinghouse E. and M. Co., Niagara Falls, N. Y.

Eighth Annual Meeting, Canadian Electrical Association.

A very successful meeting has just been concluded at the Windsor Hotel, Montreal, by the Canadian Electrical Association, being the eighth annual convention of that body. The meeting was conducted by President Yule, of Guelph, Ont., who delivered an excellent inaugural address. Papers were read by Mr. A. A. Wright on "How to Overcome Some of the Difficulties Encountered by Central Station Men;" L. W. D. Magie on "The Electrical Utilization of Water Power;" W. T. Bonner on "Goods Traffic on Suburban Trolley Roads." Visits were paid to the Lachine Hydraulic Works, the Bell telephone exchange, the Montreal street railway system, etc. The convention closed with a banquet at the Windsor, when speeches were made by members and guests, about 150 being present.

New York Electrical Society.

The following members of the New York Electrical Society who have changed their residence are requested to send their new address to the secretary, No. 120 Liberty street, New York City: B. F. Sherman, R. S. Dobbie, D. D. Book, H. Van Sands, Fred Reed, C. W. Raymond, W. F. Collins, C. E. Hart, J. Egan, G. C. Webb, D. H. Washburn, J. C. Harris, W. Schwein, A. S. Miskin, J. W. McLogan, Meno Fedden, W. A. Giles, Thomas Bennett, T. A. Fowler, S. J. Harris, C. E. Chinnock, R. Crawford, A. C. Greenberg, B. F. Card, A. B. Bennett, N. Hall, J. D. Underhill, J. A. Cabot, W. E. Lamb, E. Denning, R. A. Mitchell, R. Leichman, H. A. Dingle, C. Herman, Leo. Bock, Jr., H. F. Salamons, A. G. Holcombe, L. J. O'Reilly, A. V. Waldron, Harry Cette, C. A. Thompson, E. E. Stark, J. T. Palmer, T. F. Grover, J. C. Henry, J. W. Doyle, R. Varley, C. H. Wright, C. C. Gartland, John Deane, Jr., F. E. Dolbier, C. A. G. Groenbeck, James Stewart, C. F. Green, M. W. Grovesteen, G. Arnold, J. S. Cobb, D. H. Starralt, E. Voelckel, G. R. Shepard, W. L. Tamblyn, A. Stamm, C. J. Bickley, H. B. Niles, J. McMahon, E. S. Reid, J. H. Longstreet, M. B. Meddler, C. P. Gott, A. C. Barrett, A. W. Steiger, E. C. Miller, A. McKinnon.

Digitized by Google

MISCELLANEOUS

Alternating Current Transformers—From the Station Manager's Viewpoint.[1]—I.

BY W. F. WHITE.

IN the early days of alternating central station development, many a sale of alternating central station equipment was lost to direct current competitors by the facts, figures and fancies which the salesmen of direct current apparatus were able to advance concerning the wastefulness of energy, the expense of maintenance, and the danger to life which purchasers must accept as inseparably wedded to any transformer system.

Notwithstanding that the danger to life was unfortunately made much of, and the facts grossly misrepresented, still the correctness of many of these arguments, in the light of present knowledge, stands up remarkably well under the scrutiny of qualitative analysis. And it is even more remarkable, in view of the natural tendency to exaggerate, induced by zeal to make sales, how little, if any, were the facts as to these evils overdrawn or magnified. Quantitative analysis, in fact, proves that most figures then given to show the amount of transformer "leakages" were understated. On the part of salesmen this was undoubtedly more a mistake of the head than of the heart, for while some few of them knew the results of some isolated tests of some particular size of one type or manufacture of transformer, no one, whether salesman, engineer and designer, or manufacturer, had any knowledge or conception of the cumulative effect of transformer losses on the station output. Such little knowledge as had then been acquired related more to the transformer efficiency under certain percentages of rated load, than to all day efficiency, or the twenty-four hour ratio of energy output to energy absorbed under average conditions.

Little, if anything, was known of transformer core losses, and the effect of power factor on station and line capacities had not had consideration. As long ago as 1892 the writer, in making a careful examination into the operations of one of the then largest alternating stations in this country, made the discovery that with a net meter rate to consumers of about twenty (20) cents per 1,000 watt hours, the income per k. w. hour output at the switchboard was only about six cents, showing an average loss from station switchboard to consumer's meter of about seventy per cent.

Current was supplied in accordance with the then existing universal practice, through one or more transformers for each customer. In two or three cases, for large installations, as many as eighteen or twenty transformers were erected for a single customer, no transformer of more than 75 lights capacity being used, the transformer primaries being connected in multiple, but the secondaries feeding entirely distinct and separate circuits.

Of each 1,000 watt hours output at the switchboard, it was estimated that approximately 300 watt-hours were delivered through the customers' secondary meters, 600 watt-hours were accounted for by transformer core losses, leaving 100 watt-hours to be accounted for by transmission and other losses.

A statement of these conclusions to a well known manufacturer who had supplied the wattmeters and many of the transformers, elicited the opinion that either the primary meters registered too fast or the secondary meters too slow.

A meter expert from the factory accordingly spent several weeks in testing all primary and secondary meters, found them correct and proved that the apparent discrepancy was not due to the meter end of the plant equipment. With the writer's recommendation that a three-wire secondary network be erected, using 100-volt lamps, and fed through large transformers at frequent centres of distribution, the matter was dropped; but there is no doubt that the proportion of the output attributed to transformer losses was approximately correct.

Since that time it has been the writer's good fortune to be in touch with a considerable number of alternating plants, giving him knowledge of their operating results, and he does not hesitate to assert that very few plants exist giving continuous service, using separate transformers for individual customers, and charging from twelve cents to twenty cents per 1,000 watt hours, secondary meter measurement, whose income per k. w. hour output at the switchboard exceeds from four cents to seven cents. In other words, the ordinary transmission, transforming and distribution losses are commonly as much as 200 per cent. of the customers' demands, as shown by the customers' meters. This does not mean operating expenses three times as great as if all these losses were eliminated, but it does mean that large expenditures are made for fuel and feed water for the keeping warm of numerous transformers operating about twenty hours per day with open secondaries. And great numbers of small transformers also mean great variations of secondary voltage, large bills for lamp renewals, unsatisfactory service, and a reduced number of lamps which can be served at any instant from a given generator capacity. To show the benefits to be derived by using a secondary network, fed by large transformers working in multiple, but located one at each feeding point or local centre of distribution, as compared with the use of small transformers, one or more to a customer, the writer presents some results accomplished by an existing plant in remodeling its transformer system in accordance with these ideas.

Jan. 1, 1895, this plant was serving 16,702 incandescent lamps (16 c. p. equivalent) through 547 transformers of 22,190 lamps rated capacity, each transformer averaging 40.6 lamps capacity and serving 30.6 lamps. The transformer load, with open secondaries, was, as near as could be determined, about 80 amperes, at 1,000 volts. In view of the fact that the maximum load never exceeded fifty per cent. of the lamps' capacity connected, it was evident that a very considerable reduction could be made both in the number of transformers connected and in their aggregate capacity, by the use of a secondary network. The theoretical limit was to reduce the transformer capacity to equal the maximum load, which would lower the capacity connected from 22,190 lamps to about 8,000 lamps, a reduction of about 64 per cent. This limit was evidently impossible of attainment, because of the large number of isolated installations, especially in the residence districts, requiring individual transformers which of necessity must generally be of capacity equal to several times the average load. A system of three-wire secondary networks was laid out, and estimates made showing a possible reduction of almost 80 per cent. in the number, and of about 50 per cent. in the lamps' capacity of transformers connected. A large number of tests of core losses of all sizes of transformers in service was then made, for estimating the total core losses for the plant and for comparisons with the estimated core losses of the large transformers to be erected in replacing the old.

An illustration of one or two of these comparisons may be of interest. One installation of approximately 700 lamps was fed through a large bank of small transformers having an aggregate core loss of 4,440 watts, which could be replaced by two transformers having a combined estimated core loss of 310 watts. On the basis of the number of watt hours per pound of coal then being produced by the plant, not taking into account any line losses, this example shows the following results:

	Tons coal.
4,440 watts—38,894,400 watthours per year require.....	190.6
310 watts— 2,715,600 watthours per year require.....	8.4
Annual saving, 36,178,800 watt-hours per year require.....	182.2

The annual income from this installation was about $2,100.00, at 12 cents per 1,000 watt-hours. With a secondary output of about 17,800,000 watt hours, and transformer core losses of about 36,894,400 watt hours, the income per k. w. hour output at the switchboard for this installation was very evidently less than 0.04, and the core losses were more than double the total secondary output.

[1]Paper read at the General Meeting of the A. I. E. E., Omaha, June, 1898.

CHILI. A company has been formed at Berlin, under the title of the Electric Power Company of Santiago de Chili, with a capital of 24,000,000 marks, of which Wernher, Beit & Co., of Berlin, take 12,000,000 marks, while the balance is taken in equal proportion by the Société Génerale d'Electricité. Part of the capital will be offered for subscription in England. Extensive electrical undertakings in Chili are soon to be started by the company.

Digitized by Google

Silver Plating Plant at the Hotel Metropole, New York.

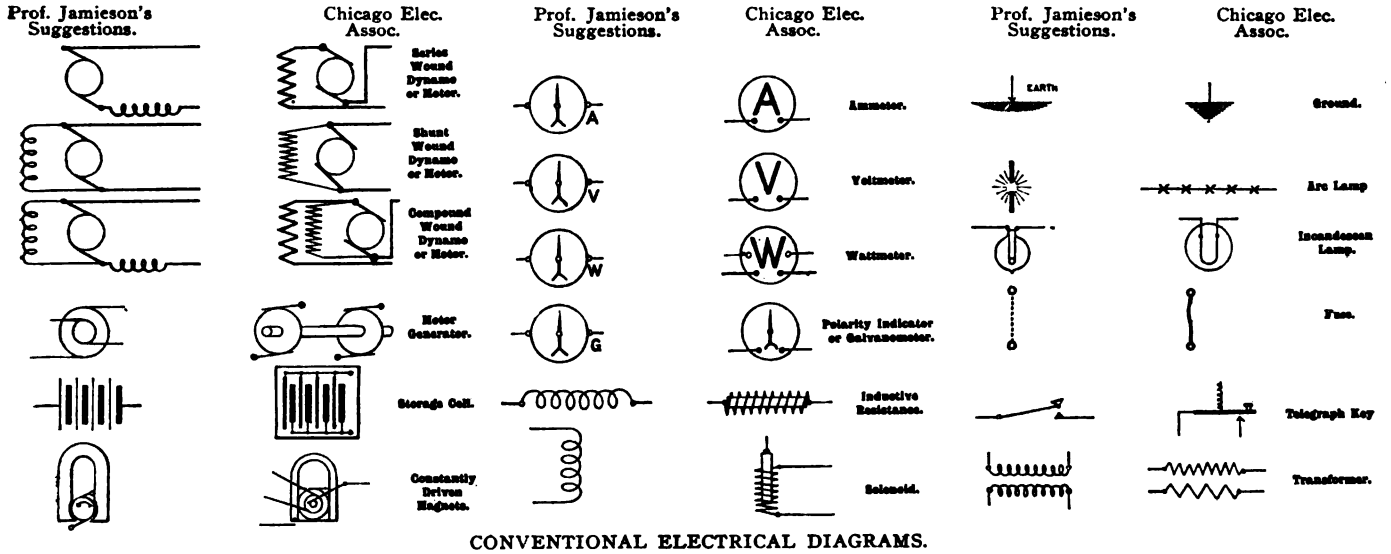
OWING to the hard usage to which the silverware in a modern hotel is put, and the large number of silver-plated articles in use at such a place, the management of the Hotel Metropole, at Forty-second street and Broadway, New York, saw fit some time ago to install their own silver-plating plant to renovate all articles from which the silver had been worn off. The plant, which has been in operation for some time, has fully justified the first cost of the outfit, and has shown the economy and feasibility of this novel scheme. The United Electric L. & P. Company, which supplies current to the hotel, leads its high potential circuit into the sub-cellar, where it is transformed to 220 volts by means of two 1,000-light converters. In close proximity to this place the hotel management has installed the silver-plating plant, which consists of the following apparatus: A 2 h. p. 200-volt 2-phase Tesla motor running at 1,800 revolutions per minute, belted by means of a countershaft to a buffer running at 3,000 revolutions per minute, and a plating dynamo delivering 75 amperes at a pressure of 5 volts; the necessary fuses, an overload circuit breaker and the conductors, which in this case are hollow copper tubes, leading to the various vats. There are in all four of these vats, each holding 25 gallons of liquid. They are the nickel, copper, silver and striking solutions, the use of which will be explained later. The writer witnessed the plating of an old soup ladle which had been discarded some time ago on account of its utter uselessness as a piece of ornamental tableware. To better understand the operation of silver-plating this ladle, let us follow each step as though we were watching the process. At first, the article is buffed until it appears clean and free from oxides or dirt. It is then dipped repeatedly in hot triple X lye in order to remove all traces of grease, after which it is washed off in water. It is then placed in a copper bath where it receives a very thin but complete coating of copper. It is now taken to the buffer again and given a high polish, stale beer being used during this operation, after which it receives a thin preliminary coating of silver in the striking solution which prepares it for its final coating of silver. The duration of each process is left entirely to the trained judgment of the operator, who can judge the thickness of the deposit by the action of his electrolyte and the amount of bubbles given off at the electrodes. After the article has been thus plated, it is dried off by being placed in sawdust, and is then finally given its exquisite polish by means of the buffer.

The entire operation, which has lasted less than twenty minutes, makes the article as good as new at a very small expense of energy. The small plant installed here is said to be of sufficient size to handle all the plating of four hotels of this size, only one or perhaps two operators being required to handle this output. As the operator at this hotel is not kept busy constantly, the guests not eating the silver off with sufficient rapidity, he devotes the remainder of his time to the buffing of the silverware. Mr. J. M. Lux, the treasurer of the hotel, to whom much credit is due for this novel installation, states that the management has effected a considerable saving in silver-plating expenses since this plant has been installed. Mr. Max Wahl is chief engineer of the hotel and Mr. D. Valintini, an experienced silver-plater, is employed as operator. There is obviously an illimitable field for the extension of such work.

Prof. Andrew Jamieson's Suggestions Regarding the Conventional Electrical Diagrams.

IN our issue of February 24, 1898, we published in the form of a double data sheet the conventional electrical diagrams embodied in the report of a special committee of the Chicago Electrical Association. These diagrams, which were submitted for the consideration of electrical engineers in this country and abroad, have met with considerable favor and will no doubt bring about finally the much desired uniformity of electrical diagrams. We are, therefore, pleased to note the suggestions offered by the eminent English authority, Prof. Andrew Jamieson, which we publish below together with an abstract of a letter to the London Electrical Review, accompanying the diagrams. After complimenting the Chicago Electrical Association on their energy and ability in going one step further than any other similar association has ever done, Professor Jamieson continues as follows:

In the first place, their figures for series, shunt and compound wound dynamos or motors, have the objections of representing the field coils by zig-zag lines which have hitherto been universally adopted to represent non-inductive resistances, whereas the field coils of such dynamos are anything but non-inductive. Further, in the case of the series and compound wound dynamos or motors, their diagrams are unnecessarily complicated by drawing the leads from each brush with two right angles, whereas in the diagrams usually adopted by electricians, and shown in my figures to the left, the leads come straight away from the brushes.



CONVENTIONAL ELECTRICAL DIAGRAMS.

Their figure for a motor generator is greatly simplified, and conveys the full meaning desired to be imparted by that which I have shown on the left.

With regard to the storage cell, I think all that is necessary to distinguish it from a primary battery are the letters S and B respectively, placed underneath the usually accepted sign of long thin and short thick parallel lines.

Granted that there are cases where it might be necessary to distinguish between the hand generators at subscribers' stations and the power generators at a central office, I don't see the slightest necessity of complicating the figure of a constantly driven magneto by inserting lines to represent the belt when a mere arrow on the armature spindle would be sufficient, as shown by my figure to the left of theirs.

With regard to ammeters, voltmeters, wattmeters and polarity indicators, or galvanometers, I think you will agree with me that those shown on the left are much simpler, neater, and sufficiently distinguished from each other by the letters A, V, W and G.

Digitized by Google

In the representations of an inductive resistance and a solenoid, it will be noticed that the iron core is omitted in my suggestion as shown on the left. Surely, the fact of a wire being coiled in a spiral form is sufficient to convey the idea of the presence of a certain amount of self-induction?

With respect to the next diagram, we do not in this country speak or write of a connection to the "ground," but to the earth, and what could be more in harmony with the well known and long accepted telegraph symbol as shown on the left?

There can be no objection to a number of crosses, as shown, to represent arc lamps in series, but for the indication of a single lamp I should recommend the diagram on the left.

My next three diagrams, as representing an incandescent lamp, a fuse, and a telegraph key, are also more in conformity with practice than the corresponding ones indicated by the Chicago Association.

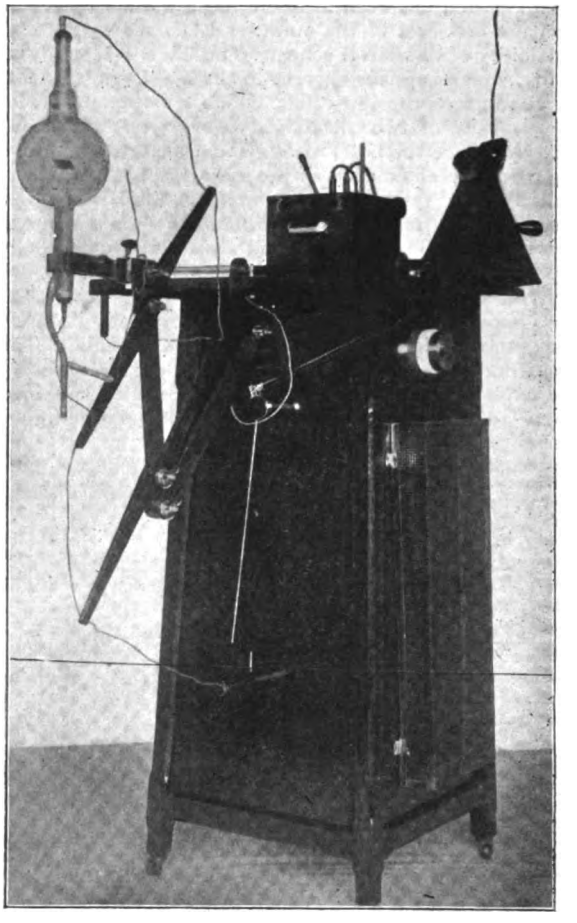
Finally, we have again to find fault with their use of the well known symbol for non-inductive resistances in the representation of a transformer.

Other objections might have been found, but these are sufficient to show a diversity between American, British and Continental practice, and hence the need for coming to an early state of uniformity.

ROENTGEN RAYS

The Fessenden X-Ray Apparatus.

AN improved and convenient R-ray apparatus, and one which has met with considerable favor among medical men and in hospitals, has recently been placed on the market by the Fessenden Manufacturing Company, 136 South Beatty street, Pittsburg, Pa. The machine, which is illustrated below, is designed for use with any direct current, either that from storage batter, primary battery or from a 110, 220 or 500-volt circuit, and by the use of a rotary transformer, which the company also manufactures, an alternating current can be used. The apparatus is mounted in portable square cabinets, those for a 6-inch spark, as illustrated, being about 18 inches square at the base and 3 feet in height, tapering slightly to the top. It is provided with a jointed or flexible wooden arm for holding the tube and connections, which has a range of about 4 feet, so that the tube can be adjusted in any position. The resistance coils are contained in a porcelain plate, mounted on one side of the cabinet and protected with a perforated brass cover. The interior mechanism consists of primary and secondary coils. The primary coil and core are encased in a hard rubber tube, which is about three inches in diameter, which is placed in a vertical position at the axis of the cabinet, and extends from the bottom to the top. The core is made up of very fine soft iron wire, insulated by shellac, and about this is the primary winding. The secondary coils are wound in three sections in the form of a disc or pulley about 12 inches in diameter, with a 3-inch face. These coils embrace the vertical tube and are about 2 inches apart, and have the appearance of three pulleys on a vertical shaft. This arrangement prevents the possibility of the secondary coils becoming overheated, or the insulation breaking down, and the manufacturers claim that not one of their coils has ever failed from any cause. On the top of the cabinet is a small 6-inch square case, which contains a small motor, that is placed with its armature directly over the magnet core, and runs in oil. This motor consists of a small wheel 4 inches in diameter, with a 1-inch face, which is made of brass, and has iron armature pieces set in. It has a 4-section commutator about ⅜ of an inch from the face of the wheel on one side; the brush consists of a flat metal conductor, which presses against the contact segments. As the pulley revolves, being actuated by the magnetism of the core, the primary current is broken or divided, thus setting up induced currents in the secondary, which reach a very high potential, enabling a spark to pass from 6 to 12 inches in length. Handles are provided, as shown, for regulating the spark gaps. One of the gaps regulates the volume of the current through the tube, another the vacuum of the tube, and the third is a safety gap, to prevent the injuring of the tube or machine. The construction of the machine is very simple, and it can be operated by a novice from the printed instructions. With the machines are provided fluoroscopes and tubes specially made after the company's specifications. In the tube the vacuum is regulated automatically. Specially prepared plates for radiograph work are also provided, together with a developing liquid. Photographs made with these machines are unusually clear, and



IMPROVED FESSENDEN X-RAY OUTFIT.

only a short exposure is required, depending, of course, upon the portion of the body which it is designed to picture, a 4-second exposure being sufficient for photographing the bones of the hand, while for one through the pelvis only four minutes are required.

PERSONAL

Reminiscences and a Glimpse into the Future.[1]

BY PROF. ELISHA GRAY.

AFTER thanking the members of the Association for the courtesies they had extended to him by inviting him to be their guest on the trip and assuring them of the pleasure he had derived from it, Professor Gray made the following interesting remarks:

When I began my career as a so-called electrician there was no science of electrcity. We knew nothing about ohms, amperes or volts, or any of those other peculiar terms which have grown up as the science has progressed. We had to do our experimenting just about as our mothers used to make cake. You know they did not have cook books in those days, and they put about enough of this and that and the other together and made cake. Sometimes it came out good and sometimes it did not. If it failed, they did not know why it failed, and if it was

[1]Abstract of remarks made by Prof. Gray at the convention of the N. W. Elec. Assoc., Duluth, June, 1898.

Digitized by Google

a success they did not exactly know why that was either. That is about the way we had to conduct our experiments. We knew nothing about the relations of wires to magnets, resistance, etc. I remember when the first rheostat came into this country. It was a Varley rheostat with a differential galvanometer, and Charles H. Summers, of Chicago, electrician of the Western Union, had the first one. He used to carry it under his arm, and he was a great man. That was the beginning of ohms in this country—the beginning of the measurement of resistances. I have seen telegraph joints cut out that gave a measured resistance of 35,000 ohms, and yet they worked through those resistances in those days, but it did not dare to mist or rain the least bit, or the current was gone. We did not know then what was the matter with us.

I did not begin quite so far back as a certain professor of physics in my alma mater in its very early days, before the time of the telegraph, or at least before it amounted to anything—I do not think he had ever heard of it, but he was taking his class through a course of "electricity." It took him an hour one day. He showed the experiments of the frictional electrical machine, and talked to them about Franklin's having caught the forked lightning from the clouds, tamed it, and made it subservient to the will of man. You know how it goes, a regular Fourth of July speech, and then he said: "Young men, you were born too late to witness the development of this great science, electricity." I often wonder whether if the good professor is allowed to look down from his far-off home and see the progress that electricity has been making since his time, he does not often think of that little speech he made to the boys over fifty years ago on the subject of electricity. I think I should, under the same circumstances.

We had no electric lights in those days, we had no electric railroads, we did not do our cooking by electricity, we did not ride on the cars by electricity—those things were not thought of—we did not talk from town to town by electricity. I will quote a little poem as apropos of this subject, entitled the "Difference Between the Now and the Then."

"In the olden time, along the street,
A glimmering lantern led the feet,
When on a midnight stroll;
But now we catch, when night is night,
A piece of lightning from the sky
And stick it on a pole.

Time was when one must hold his ear
Close to the whispering voice to hear,
Like deaf men, nigh and nigher;
But now, from town to town he talks,
And puts his nose into a box,
And whispers through a wire.

In other days we took a car
Drawn by a horse, if going far,
And felt that we were blest.
But now the conductor takes the fare
And sticks a broomstick in the air—
The lightning does the rest."

Gentlemen, as I said before, I congratulate you that you live in this age. I congratulate you that you can begin where you are beginning in this science of electrcity. We are apt to speak of it as just on the threshold or just in its infancy. Well, it is a pretty healthy infant; yet who is bold enough to say that it is not yet comparatively in its infancy? I do not know what the outcome is to be, but I am sure we have not reached the end by a long, long way. I expect—no, I do not know that I expect to see it—but I think some of you may see it, and if you do not, some of your children will, see the time when we will have done away with the steam engine, when we will take the energy which is stored in the wood and the coal, directly as electricity, without having to put it through the steam engine and the dynamo, for the various uses to which it can be put. I say, I think that that time is coming. It may not be reached in our lifetime, but it seems to me legitimate that we may look forward to that. We will have no use for it. We will remember steam very affectionately for what it has been in the world, and what if is to us now, but there will be no necessity for its use then.

MR. H. G. ISSERTEL, E. E., has taken the management of the New England office of the Walker Company and will have his headquarters at room 313, 53 State street, Boston, Mass., where he will be glad to welcome old friends and new orders. He is a former New Englander, in the electrical sense, having been one of the corps of experts of the old Thomson-Houston Company, and having assisted in the construction of such roads as the Boston West End, the Lynn & Boston, etc.

LIEUTENANT WOOD, of the Ball & Wood Engine Company, New York City, was prominent in the great fight in which Cervera's fleet was smashed, and as an officer of the saucy yacht "Corsair," now the "Gloucester," had no small share in the glory of "doing up" the two torpedo boat destroyers at the same moment. Lieutenant Wood's name was mentioned in many of the newspaper dispatches, and his associate, Mr. C. R. Vincent, has now had the pleasure of getting a cable message from him, via Jamaica, stating the news of the glorious victory and saying that he is well and ready for another.

The Skinner Automatic Engine and Improved Lubricating System.

THE Skinner engine has attracted the attention of engineers on account of its close governing qualities and efficient system of lubrication. The engine, which is shown in perspective in Fig. 1 has attached to it a governor, built on Shepherd's patent, which consists of but three operating parts mounted in the wheel, and is probably the only type of governor which will respond to sudden change of load without racing, in which friction is entirely eliminated. According to reliable tests made with this governor, the same speed was maintained with steam at 30 pounds and 125 pounds, and the speed was changed 30 per cent. by simply adding to or taking from the weights, requiring no other adjustment of the governor. The manufacturers guarantee this governor to regulate within one-half of one per cent.

The most remarkable feature of this engine, however, is its novel system of lubrication, shown in Fig. 2. This system does not necessitate the taking away of the oil for filtration, and it is

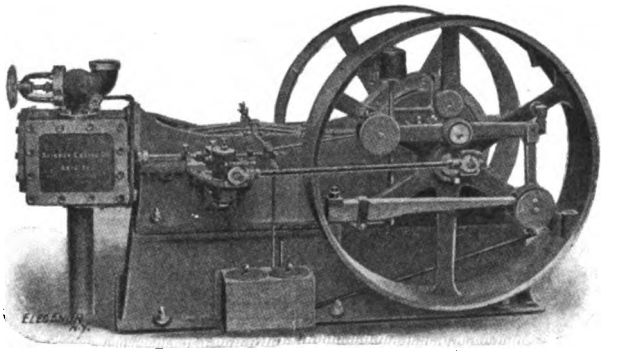


FIG. 1.—SKINNER AUTOMATIC ENGINE.

claimed that the attendant need not touch the lubricating apparatus from one year's end to the other.

The new features in this system are: Adjustable oil feeders, through which oil is conveyed to sight-feed glasses, and which can be swung away from the glasses when access to the interior of the engine is desired. A noiseless pump with a positive motion valve. An oil and water separator, absolutely preventing water from reaching the supply tank. An oil purifier in connection with the supply tank. All pipes and connections outside of the bed in full view and reach of the attendant. Not a strainer nor any filtering material, such as waste or sponge, to obstruct free circulation of oil through the entire system. The feed is in plain sight of the attendant.

After passing through the engine, the oil is separated from

Digitized by Google

the water that naturally follows it, is conducted to a filter which cleans it, and when it again enters the engine it is just as pure as when first introduced.

These features are entirely new and novel, patents for which are now pending. The manner in which it is attached to the engine is such as to enable the operator at all times to have ready access to any part of the engine for adjustment or examination, and by loosening three screws the entire feeding mechanism can be removed from the engine.

Referring to Fig. 2, which shows very plainly the details of the system, the guides, cross-head and cross-head pin are oiled by a jointed tube overhanging the guides, the oil reaching the guides and dropping through the sight-feed glass in each guide, the feed being regulated by feed screws for each glass. The feed tube is hinged to the bracket bolted to the top of the bed. No adjustment of screws is necessary to stop the feed. Raising the tube to the vertical position, shown by the dotted lines, shuts off the oil. When the feeder is in this position, ready access to the cross-head and connecting rod for adjustment is afforded. Both the main bearings are oiled by an arc tube, which also supplies the oil necessary for proper lubrication of the crank, through the same glasses that oil the bearings. The feeder is hinged to brackets bolted to the top of bed, and when an examination of the crank is desired, the feeder can be thrown back from the crank, as shown by the dotted lines. When in this position the oil supply is shut off. These jointed feeders can be entirely removed from the bed by loosening a screw at each joint. Oil is furnished to the feeders from a reservoir located above the bed, shown in Fig. 2. The oil is forced to this reservoir by means of a pump attached to the valve slide. The capacity of this pump is greatly in excess of that required to oil the engine, keeping the reservoir full of oil at all times, any oil in excess of the wants of the engine being returned to the supply tank by means of a pipe, provided to take care of this overflow. This pump has a positive motion

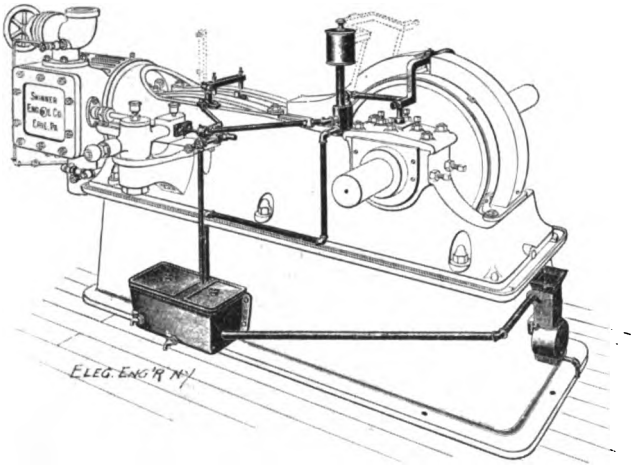


FIG. 2.—SHOWING LUBRICATING SYSTEM OF SKINNER AUTOMATIC ENGINE.

valve similar to a piston valve in an engine. It is perfectly noiseless and not liable to become obstructed. The valve seat and valve can be removed from the pump and when removed the oil is prevented from escaping from the pump and is carried to the feeders from the reservoir the same as though the pump were working. The valve can be cleaned and replaced in the pump, when it immediately starts to work again, and it is not necessary to stop the engine nor is the oil feed interrupted.

When the oil leaves the engine it is more or less mixed with water that comes from the piston and valve rods. This enters a receptacle at the end of the bed, which is an oil and water separator. This is an entirely new thing in mechanics. Water and oil flow into this separator, as fast as it comes from the engine, and every particle of oil will be separated from the water and conveyed by means of a pipe back to the supply tank. part of this supply tank being a filter, and the oil is cleansed from all impurities, entering the supply tank proper in as good condition as it was when originally put into the engine. A constant stream of oil is fed to every part of this engine, and the manufacturers state that they guarantee that not a particle of oil will reach the foundation or room that it is placed in.

From tests made the builders guarantee that an engine of 50 h. p. capacity can be operated ten hours per day for one year on a consumption of but five gallons of oil; that at no time will the oil in use show more than ¼ per cent. more friction than sample from barrel, and that the system will require no attention from the attendant other than renewing the oil from time to time. The only loss, therefore, is from actual wear.

The engine is manufactured by the Skinner Engine Company, of Erie, Pa.

Purification of Boiler Water.[1]

ONE of the most universal causes of inefficiency in small power plants is scale on the inside of boiler flues. This causes not only a loss of fuel by reason of poor conductivity for heat, but also abnormally heats the boiler plates and flues, and causes them to expand to such an extent that leaks of the boiler will be the eventual result. Even explosions may be caused by the sudden breaking away of the scale and admitting the water to highly heated plates, suddenly contracting them. and in so doing, breaking off more scale, and at the same time generating an abnormal amount of steam.

In a power plant that we have erected recently, we have attacked this problem in a different way from that common in this country, although the method is used to some extent in England and Germany.

In order to get a pure water for the boiler, we constructed two tanks 46 and 6 feet deep. They are filled with water from the hot well of the jet condenser, and at the same time a small amount of whitewash is added to the water. The exact amount can be determined by a very simple chemical test. If a little of the water is taken in a tumbler and a few drops of a weak solution of silver nitrate is added, it will give a red precipitate if a sufficient amount of lime has been added. Care should be taken not to add a great excess of lime, although a very small excess will do no harm. After allowing it to stand for about half an hour, a solution of soda ash is added, and then if the water is at all muddy, a very little alum is added. This, however, is not necessary except with quite muddy water. Within an hour the water will begin to turn a greenish-blue, and within two or three hours it may be drawn from the top if necessary, although we prefer to give it 12 to 15 hours to settle in if possible. But even in case we are not able to give it any time at all to settle, we have the water under conditions as favorable as can be obtained by the use of any compound directly in the boiler. Where time is given for the water to settle, all the impurities are in the bottom of the cistern, instead of in the boiler, or, at least, 95 per cent. of them, and a perfectly clean boiler results. The whitewash is added to precipitate all the soluble bicarbonate of lime in the form of the normal carbonate, which is almost absolutely insoluble. The soda ash is added to precipitate the sulphate of lime and the excess of the whitewash.

The water that we operate on contains almost no sulphates, and at first we added only the whitewash, but we found although the boiler scaled but very little the scale that was formed was very tenacious. However, after adding soda ash to remove the excess of lime, we found no scale at all was formed on the flues, and the very small amount of precipitate that found its way to the boiler never caked, but remained as a very flocculent mud until blown off.

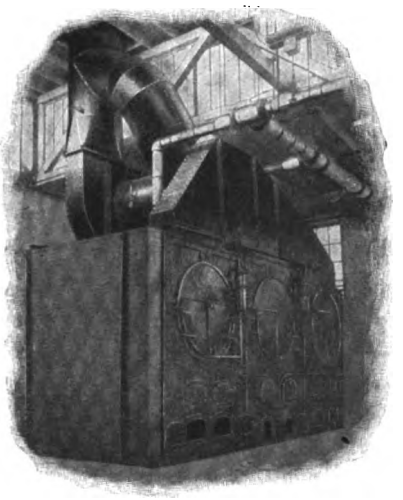
A Chimney That Had Outlived Its Usefulness.

WHEN the tracks of the N. Y., N. H. & H. R. R. were recently elevated at Jamaica Plain, Mass., it became necessary to remove a number of the adjacent buildings of the B. F. Sturtevant Co. and to change the location of the existing boiler plant. The chimney, which had previously served as a means of producing draft, was thus rendered absolutely useless because of its distance from the new location of the boilers. It therefore became a question whether another chimney should be erected or a fan employed to produce the draft. Naturally the latter method was adopted, for the B. F. Sturtevant Co. are large manufacturers of fans and are installing

[1]Abstract of paper read by Mr. Dow, of Midland, Mich., before the N. W. Elec. Assoc., June, 1898.

Digitized by Google

large numbers for the purpose of mechanical draft. Accordingly, a specially designed fan was placed on top of the boilers, connection was made to the uptake, and a short stack was provided extending just through the roof. The general arrangement of the apparatus is shown in the accompanying illustration. The fan is equipped with a direct connected upright engine, the speed of which is so regulated by an automatic device that the draft is materially increased when the steam pressure

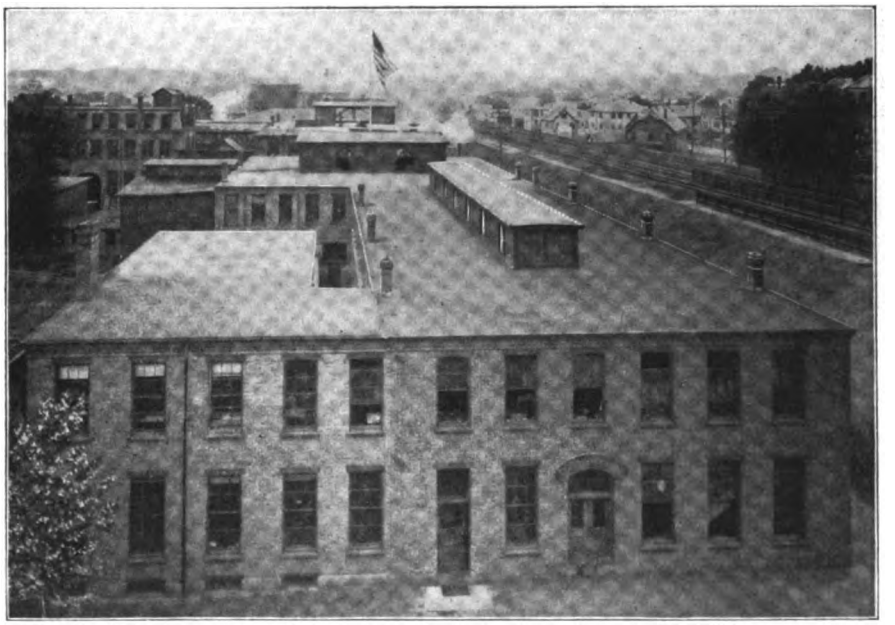


STURTEVANT MECHANICAL DRAFT FAN OUTFIT ATTACHED TO BOILERS.

falls slightly. The result is practically constant steam pressure. The arrangement has required no attention, fulfils the requirements, makes possible the burning of cheaper fuel, and has a marked influence in the prevention of smoke.

The deterioration of the unused chimney and the utilization of its bricks in the erection of a new building has led to the recent removal of the old means of draft-production, and the passer-by is now favored with the unusual spectacle of a large manufacturing establishment without a chimney, or at least anything that appears to be comprehended by the ordinary definition of such a structure. The accompanying view represents the works as they now appear, the present steel plate stack from the fan being visible on the right about half way down the length of the buildings. That such means should serve as an efficient substitute for the chimney is not evident until one considers the peculiar adaptability of the fan for such a purpose. Inasmuch as it is usually built of steel plate, its construction may be such as to most perfectly fulfil the requirements, for it may be used either for forcing the air to the ash-pits or exhausting it from the uptake; it may be placed above the boilers or in any location where the space is not valuable; its capacity may be varied at will; great intensity of draft may be maintained without reference to the conditions of the weather, which so often affect the working of a chimney; the draft may be maintained while the waste heat in the gases is utilized by the economizers, and above all it can be installed for far less first cost than a chimney.

The rapidity with which this method of draft production is being adopted certainly warrants the assertion that the time is at hand when such evidence of its use as is indicated by the absence of a chimney will be found on every hand.



A MANUFACTURING ESTABLISHMENT WITHOUT A CHIMNEY.—EQUIPPED WITH STURTEVANT MECHANICAL DRAFT FAN OUTFITS.

NEWS & NOTES

Street Railway Receipts in 1896 and 1897.

The valuable and useful standard publication known as Street Railway Journal's Financial Supplement, "American Street Railway Investments," contains in the 1898 edition, just published, an interesting and instructive comparison of the gross receipts for 1896 and 1897 of the principal American street railway properties, 175 in number. It appears that there are no fewer than 26 properties earning $1,000,000 or more; 19 earning from $500,000 to $1,000,000; 46 earning from $100,000 to $500,000. The figures for 84 properties earning less than $100,000 are also included in the comparisons. In the first group, including the principal street railway properties of the country, the gross receipts for 1897 were 2.2 per cent. greater than the receipts for 1896; in the second group, the receipts decreased 0.11 per cent.; in the third group, comprising the 46 properties earning from $100,000 to $500,000, the receipts increased as a whole 1.67 per cent.; and with the smaller systems there was but a slight variation in the receipts for the two years. The entire 175 properties which are presented in tabular form in the "Red Book" show an increase in receipts of 1.9 per cent. in 1897, as compared with 1896.

These increases are all much smaller than those shown in 1896 over 1895. In these two years the difference in gross receipts was 7.4 per cent. of the 1895 figures. Although these compari-

Digitized by Google

sons are for a portion only of the street railways of the country, they seem to indicate that the latter have just about held their own in 1897, but have done little more than this, and have not kept up the rate of increase promised by last year's reports.

This supplement to the Street Railway Journal contains, as usual, a mass of interesting and valuable statistics relating to street railways, together with 24 fine maps of the more important properties. The operating statistics and balance sheets are presented in tabular form, so that the returns for four or five years past can be inspected without the necessity of referring to previous editions of the book. We believe that this is the only publication of this character in which balance sheets from year to year are directly compared, and yet it is undoubtedly true that the financial condition of properties is never completely understood unless the closest inspection of balance sheets be made, for padding or concealment of earnings is usually brought to light only in the balance sheets.

Illumination of the Grand Canal, Omaha Exposition.

IN addition to the pictures we have already published of the Grand Canal at the Omaha Exposition and of the electrical fountain and effects there, we now present an admirable night view of the scene. The notable fact about this illumination is the entire absence of arc lights. The whole effect is obtained by the use of incandescent lamps of 8 and 16 c. p., at 104 volts. The 8 c. p. lamps are used along the outlines of the buildings. The 16 c. p. lamps are employed around the canal and on certain high points. The plant for the Nautilus fountain around the columnar statue of Neptune, as well as for the illumination, is due, as already noted, to Mr. Stieringer, who was wishful of demonstrating what could be done with incandescents alone out of doors on this large scale. The results, in the large volume of light and in the brilliancy and beauty of the scene, more than justify his predictions. The construction work and details have been carried out by Mr. Henry Rustin, the superintendent of electric light and power at the Exposition.

ILLUMINATION OF THE GRAND CANAL, OMAHA EXPOSITION.

Electric Traction on an Ohio Canal.

Under an act passed by the Ohio Legislature last spring, an experiment with electric traction on canals is to be made on the Miami and Erie Canal by a trolley railroad company. The plan proposed is a novel one. It is to build a standard gauge track on the towpath on which will be run an electric motor, receiving its power by an overhead trolley. The motor designed for this work will be of 100 h. p. and will, its designer expects, easily pull a tow of at least five heavily laden boats, or more tonnage than a 300 h. p. engine can pull on rails. The track will be ballasted to an even surface so as not to interfere with the drawing of boats by mules. In the event that the experiment succeeds, the reward of the trolley company will be the right to operate a line of boats for a term of years, paying to the State the same tolls as are now paid by mule-drawn boats.

A New Application of Hertzian Waves.

To obviate the use of the usual conductors in burglar alarm systems for safes, vaults, etc., Mr. Clyde Colman, a resident of Chicago, has invented a system employing Hertzian waves. In accordance with this invention the connecting conductors are entirely dispensed with and a transmitter is provided in the protected structure, which is thrown into operation immediately upon any tampering with the protecting barrier, so as to produce a series of vibrations capable of transmission through the intervening medium to actuate a cohering receiver at the alarm station. The receiver closes the local alarm circuit, causing the bell or other means to produce a signal until the attendant stops it by decohering the particles between the electrodes.

Production of Electrical Energy by the Direct Action of the Atmosphere.

This is the claim made by Mr. Henry N. Warren, who describes the following experiment in the Chemical News, Vol. 76, p. 200, to demonstrate the feasibility of his scheme. Plates are prepared of a special porous compressed graphite, and about one-quarter of each plate is rendered active by immersion in platinic oxalate, drying and igniting in an atmosphere of hydrogen. In contact with a solution of ferrous sulphate, the platinum surface induces oxidation of the iron by the oxygen of the atmosphere. Several of these plates are attached to a circular lead beam, which surrounds a porous diaphragm containing as negative element a rod of amalgamated zinc, the carbons being so arranged as to allow the platinized portion to project above the solution, which consists of strongly acidified ferric sulphate. On completion of the circuit, a powerful current is at once generated, and continues until the complete reduction of the ferric salt has taken place, which naturally terminates the action. On now withdrawing the zinc, the platinum surface condensing the atmospheric oxygen steadily reoxidizes the ferrous salt, and thus renews the action when required.

Engineering Education.

The Society for the Promotion of Engineering Education will hold its fifth meeting in Room 22, of the Walker Building, of the Massachusetts Institute of Technology, Boston, Mass., August 18, 19 and 20, 1898. J. B. Johnson, St. Louis, Mo., president; Albert Kingsbury, Durham, N. H., secreary.

Digitized by Google

INVENTORS RECORD

Classified Digest of U. S. Electrtical Patents Issued June 28, 1898.

Alarms and Signals:—

ALARM SYSTEM. C. Coleman, Chicago, Ill., 606,405. Filed Sept. 8, 1897. Employs Hertzian waves and thus eliminates the use of conductors.

RAILWAY SIGNALING SYSTEM. C. H. Davis, New York, 606,450. Filed Dec. 29, 1897. A series of signal devices being arranged so that a given device cannot be set to exhibit a safety signal ahead of a train until it shall have exhibited a danger signal as many times as there are succeeding devices interlocked with it in rear of train, and unless the succeeding devices shall previously have been set to exhibit "danger."

Batteries, Secondary:—

SECONDARY VOLTAIC BATTERY. L. Epstein, London, England, 606,526. Filed Dec. 28, 1895. Employs negative plates in which lead oxide is the active material, and positive plates coated with amalgam of mercury and zinc, troughs in which the positive plates rest and in which the mercury is placed, and casings for the negative plates formed of porous, non-conducting material enclosed between walls which surround the lower part of the plate, the walls having perforations except in their lower portions.

Distribution:—

TRANSFORMER BOX AND HANGER. L. Gutmann, Peoria, Ill., 606,208. Filed Nov. 22, 1897. Combines a main body tapering toward the upper end, a tapering rim forming part of the hanger, located in a parallel plane to the main body, and recesses in the main body for retaining devices for fastening.

SYSTEM OF ELECTRICAL DISTRIBUTION. C. F. Scott and B. G. Lamme, Pittsburg, Pa., 606,589. Filed Jan. 28, 1897. Comprises an alternating current supply circuit, direct current motors, a rotary transformer taking alternating current from the supply circuit and supplying direct current to the motors and means for varying the alternating current electromotive force supplied to the rotary transformer and thereby varying the direct current electromotive force and the speed of the motors.

Dynamos and Motors:

DYNAMO ELECTRIC MACHINE. R. S. Dobbie, Jersey City, N. J., 606,407. Filed June 6, 1892. Comprises a dynamo electric machine having two or more pairs of pole-pieces and a switch for rendering the machine bipolar or multipolar at will.

ELECTRIC MOTOR. J. G. Truman, Lemon City, Fla., 606,605. Filed Jan. 10, 1894. Combines a movable armature with a series of connecting bars attached thereto and electromagnets with which the plates are also connected.

Measurement:

CURRENT INDICATOR. T. W. Varley, New York, 606,369. Filed July 2, 1897. Designed to construct and arrange astatic needles in such a manner as to form an indicator or ammeter for the current passing through a straight conductor.

ALTERNATING CURRENT MOTOR METER. J. A. Mollinger and K. Kurda, Nuremburg, Germany, 606,630. Filed Dec. 27, 1897. Comprises a shunt field consisting of two inductive resistance coils placed in series with the coil of a choking device, the core of the shunt field magnet being constructed of thick sheet iron, cast iron plate, steel plate or solid iron, and the core of the choking device of thin subdivided well isolated sheet iron.

Miscellaneous:—

INSTRUMENT FOR CALKING SHIPS. W. P. Freeman, New York, 606,199. Filed June 22, 1897. Comprises an electric motor, a reciprocating tool holder, a spring acting on the tool holder in one direction, and a Geneva gearing actuating the tool holder intermittingly in the opposite direction.

ELECTROMECHANICAL MUSICAL INSTRUMENT. G. H. Davis, New York, 606,279. Filed May 1, 1896. Details of construction.

ELECTRIC IGNITER FOR GAS ENGINES. A. J. Tackle, Oakland, Cal., 606,312. Filed Oct. 5, 1897. Details of construction.

APPARATUS FOR WELDING, BRAZING AND SOLDERING BY ELECTRICITY. A. Hirsch, Berlin, Germany, 606,342. Filed Dec. 21, 1897. Consists in so mounting and operating the electrodes in a tool that they may be adjusted at the required angle and converged, separated, and otherwise manipulated by one hand as to vary the flame as required.

ELECTRICAL SIGN. M. Norden, New York, 606,356. Filed April 12, 1897. An automatic mechanism for electric signs comprising a shaft and heads, means for revolving them, removable letter bars and contact springs carried by the same and circuit connections, a segment bar upon one of the heads and a contact brush and circuit connections.

PORTABLE ELECTRIC DRILL. E. Holmes, London, England, 606,549. Filed Nov. 18, 1897. Details of construction.

Railways and Appliances:—

ELECTROHYDROSTATIC AUTOMATIC CAR BRAKE. J. Buchel and F. McGloin, New Orleans, La., 606,330. Filed May 22, 1897. Comprises an automatic car brake, a closed fluid pressure conduit, a pump for creating a pressure therein, a brake cylinder connected to the conduit, a controlling valve in the conduit, a weight tending to keep the valve closed and an electromagnet for varying the pressure of the weight upon the valve.

Regulation:—

REGULATION OF ROTARY TRANSFORMER DIRECT CURRENT ELECTROMOTIVE FORCE. B. G. Lamme, Pittsburg. Pa., 606,560. Filed Feb. 10, 1898. Details of system.

Switches, Cut-Outs, Etc.:—

PUSH BUTTON. F. J. List, Chelsea, Mass., 606,562. Filed Nov. 5, 1897. Consists of an escutcheon provided on its inner face with a chamber and a cross bar, forming a contact point, a push button extending through the escutcheon and having its inner end broadened into a disc, the wire forming the other electrode being coiled around and upon the disc.

Telegraphs:—

PRINTING TELEGRAPH. B. A. Brooks, Brooklyn, N. Y., 606,329. Filed Jan. 20, 1894. A combined transmitter and distributer, comprising a continuously revolving shaft, a set of key levers, a circuit changer and mechanism between the levers and shaft whereby the depression of any key changes the circuit to send an impulse over the line after a predetermined time corresponding to the key.

TELEGRAPH INSTRUMENT. J. L. Cutler, Cincinnati, O., 606,449. Filed Oct. 18, 1897. Sounder. Details of construction.

Telephones:—

TELEPHONE SYSTEM. W. A. Gustafson, Joliet, Ill., 606,285. Filed Aug. 13, 1896. Comprises electric call and sound transmitting and receiving devices so arranged and combined as to be automatic in breaking and making the bell call circuit when the transmitting and receiving devices are brought into service and replaced out of service.

SYSTEM FOR ELECTRICAL COMMUNICATION. A. T. Brown, Syracuse, N. Y., 606,620. Filed April 9, 1896. Party line telephone system.

Classified Digest of U. S. Electrical Patents Issued July 5, 1898.

Alarms and Signals:—

POLICE PATROL SYSTEM. O. W. Hart, Fall River, Mass., 606,865. Filed Aug. 3, 1897. A telephone transmitter consisting of a case, a mouthpiece on the front of the case, a diaphragm at the rear of the case, a plurality of electrodes extending from the diaphragm toward the mouthpiece and provided thereat with a rigid support and means of adjustment.

Batteries, Secondary:—

STORAGE OR SECONDARY BATTERY. R. Ashley, Port Republic, N. J., 11,676, reissued. Filed April 9, 1898. An electrode consisting of horizontal, straight and corrugated metal strips alternating with each other and having spacing pieces between the ends soldered to them.

Conductors, Conduits and Insulators:—

INSULATOR. B. Willard, Schenectady, N. Y., 606,830. Filed April 18, 1898. An insulator for an electric conductor, comprising a metal cap having a receptacle which is other than round, with a body of insulating material arranged to fit into the cap and be free to move in and out, but prevented from turning therein, and means for securing the insulator to a support.

Dynamos and Motors:—

METHOD OF AND APPARATUS FOR GENERATING ALTERNATING CURRENTS. M. Hutin & M. Leblanc, Paris, France, 606,761. Filed March 13, 1894. A method of generating alternating electric currents, by causing electrical alternations of the desired frequency, and reinforcing the same to the desired volume.

ALTERNATING CURRENT DYNAMO. M. Hutin & M. Leblanc, Paris, France, 606,762. Filed April 19, 1895. Similar to above.

ALTERNATING CURRENT DYNAMO. L. Gutmann, Peoria, Ill., 606,863. Filed Dec. 4, 1897. A stationary ironclad armature, combined with field magnet core for the alternator consisting of three solid structures, a shaft for the field magnet core adapted to rotate, and means for temporarily removing the pieces from the shaft.

Electro-Therapeutics:—

ELECTRIC EXTRACTION OF POISONS. J. B. Campbell, Cincinnati, O., 606,887. Filed Oct. 5, 1896. Consists in providing the negative electrode of an electric battery, with interchangeable receivers of animal, vegetable or mineral substance, to extract a poison from the body of a nature or any kind corresponding with or to the negative electrode employed.

Lamps and Appurtenances:—

SWITCH FOR ARC LAMPS. C. A. Pfluger, Chicago, Ill., 606,939. Filed Dec. 21, 1896. Four terminal switch. Details of construction.

Measurements:—

ELECTRIC METER. W. Stanley, Pittsfield, Mass., and F. Darlington, Great Barrington, Mass., 606,795. Filed Jan. 13, 1898. Comprises a magnetic brake consisting of a rotating disc mounted upon the shaft to be retarded and a permanent magnetic system having a permanent magnet provided with a soft iron pole piece and adjustable projections engaging with the soft iron pole piece.

Miscellaneous:—

ELECTRIC RADIATOR. F. W. Quidas, Mount Washington, Md., 606,792. Filed July 22, 1897. Designed for street car use.

COMPOSITION OF MATTER FOR ELECTRIC HEATERS. G. B. Fraley, Philadelphia, Pa., 606,921. Filed Aug. 12, 1897. Consists of talc, silicate of soda, carbonate of soda and water in suitable proportions.

Railways and Appliances:—

ELECTRIC RAILWAY. J. C. Henry, Denver, Col., 606,663. Filed March 28, 1898. An electric circuit controlling device comprising two relatively movable contacts, one being rotatably adjustable so as to present different contact surfaces, and means for clamping the contact in adjusted position.

ELECTRIC RAILWAY. J. C. Henry, Denver, Col., 606,664. Filed April 7, 1898. Consists of decreasing the resistance of the field magnet circuit of one motor so as to increase the energization of the field magnet of the other motor and correspondingly decrease the armature current of the other motor.

TROLLEY HEAD. C. Grover, Kansas City, Mo., 606,711. Filed Nov. 13, 1897. Details of construction.

CONTACT DEVICE FOR ELECTRICALLY PROPELLED VEHICLES. H. P. Davis, Pittsburg, Pa., 606,819. Filed April 6, 1896. Comprises a roller, a supporting head formed of two sheet-metal strips of different shape rigidly fastened together and provided with suitable bearings for the roller, laterally extending guard and brace rods and curved tapering, sheet-metal plates forming continuations of the contact surface of the roller.

CONTACT DEVICE FOR ELECTRIC RAILWAYS. C. A. Terry, New York, and H. P. Davis, Pittsburg, Pa., 606,825. Filed March 2, 1896. Consists of a revolving cylinder, a fork carrying the same, stationary pieces at the end of the roller constituting continuations thereof and tapering outwardly, and a supporting arm rigidly joined at its upper end directly to the fork.

CURRENT COLLECTING APPARATUS FOR ELECTRIC RAILWAYS. C. A. Terry, New York, and H. P. Davis, Pittsburg, Pa., 606,826. Filed April 6, 1898. Comprises a contact supporting arm and a pivoted base to which the arm is hinged, a locking device normally

Digitized by Google

acting to hold the base against the movement on its pivot, and means actuated by the downward movement of the arm to unlock the base.

OVERHEAD CONSTRUCTION FOR ELECTRIC RAILWAYS. C. A. Terry, New York, and H. P. Davis, Pittsburg, Pa., 606,827. Filed June 10, 1896. A section insulated from the main portion, an auxiliary section bridging the insulated section, a second supply conductor crossing the insulated section and a casting having guiding arms respectively fastened to the insulated section and to the conductor crossing it.

TRAVELING CONTACT DEVICE FOR ELECTRIC RAILWAYS. G. Westinghouse, Pittsburg, Pa., 606,828. Filed April 6, 1896. A current collecting device for electrically propelled vehicles, comprising a reversible support and means for locking it in either of two positions, and a circuit closing device, one member of which is carried by the support.

ELECTRIC BRAKE. H. P. Davis, Pittsburg, Pa. 606,917. Filed Oct. 22, 1897. Comprises a plurality of electric motors arranged in parallel in a local circuit to be driven as generators, combined with a plurality of brake magnets, one in each branch of the circuit.

ELECTRIC RAILWAY. J. C. Henry, Denver, Col., 606,990. Filed April 18, 1898. Means for changing the armatures of a two-motor car equipment from series to parallel relation without excessive change or current strength.

ELECTRIC RAILWAY. J. C. Henry, Denver, Col., 606,991. Filed April 25, 1898. Similar to above.

Switches, Cut-Outs. Rheostats, Etc.:—

RHEOSTAT. H. B. Cutter, Philadelphia., 606,646. Filed June 22, 1897. Comprises a rheostat, an automatic magnetic circuit-breaker, automatic means of preventing the closing of the circuit-breaker when the rheostat arm is in certain positions and means of manually interrupting the flow of current through the automatic magnetic circuit-breaker to cause its arbitrary actuation.

ELECTRIC LIGHT SWITCH. F. L. Temple, St. Johns, Canada, 606,746. Filed Oct. 7, 1897. Means whereby the withdrawal of the key from the door of a room after locking it will extinguish the light.

ELECTRIC HEATER OR RHEOSTAT. R. Van R. Sill, New York. 606,769. Filed May 29, 1897. Consists of an outer shell and a resistance filling therein in the form of a spiral layer of comminuted material with the convolutions in contact.

FUSE BOX. J. B. Smith, Manchester, N. H., 606,771. Filed Feb. 23, 1897. Details of construction.

ELECTRIC SNAP SWITCH. A. F. Wood, Philadelphia, Pa., 606,884. Filed Oct. 8, 1897. Details of construction.

LIGHTNING ARRESTER. W. E. Athearn, Brooklyn, N. Y., 606,954. Filed Aug. 9, 1897. Comprises a spiral spring retained on a porcelain block by a fusible wire.

Telegraphy:—

MACHINE FOR PUNCHING TELEGRAPHIC PAPER. G. M. Gibson, Chulmleigh, England, 606,658. Filed July 26, 1897. Details of construction.

Telephones:—

TELEPHONE EXCHANGE. F. A. Lindquist, Chicago, Ill., 606,764. Filed May 19, 1897. Details of construction.

TELEPHONE SYSTEM. B. R. Dodge, Post Mill Village, Vt., 606,803. Filed June 17, 1897. Party line system.

TELEPHONIC TRANSMITTER. T. F. Ahern, Detroit, Mich., 606,852. Filed June 19, 1897. Consists of two substantially triangular carbon electrodes placed in frictional contact, the area of which is varied by the sound vibrations of the diaphragm carrying one of the electrodes.

MEANS FOR PREVENTING DISTURBANCES IN TELEPHONIC CIRCUITS. O. T. Blathy and K. De Kando, Buda-pesth, Austria-Hungary, 606,912. Filed April 27, 1897. Employs monophase or polyphase alternating current plants which have one of the conductors grounded, with alternating currents of a frequency less than twenty complete periods per second, incombination with monophase or polyphase alternating current motors with slantwise slots, for preventing disturbing influence on telephone apparatus.

REPORTS OF COMPANIES

Nassau Electric Railway Readjustment.

The readjustment of the securities of the Nassau Electric Railway Company and its leased and controlled companies is practically completed. The consent of the stockholders has been secured, and the Kings County Traction Company's shareholders have turned in all their stock. Under the plan the capital of the Nassau Company is increased sufficiently to absorb all the other companies. The new company will have a capitalization of $6,500,000 of 4 per cent. preferred stock, and about $8.000.000 of common stock. It will also issue $13,500,000 of 4 per cent. bonds, $1,500,000 of which are to be held in the treasury. The new common stock will be distributed among the present common stockholders pro rata. The bondholders exchange their 5 per cent. bonds for the new 4 per cent. bonds and 20 per cent. in preferred stock. The bondholders of the Atlantic Avenue Railroad first and consolidated 5 per cent. mortgage bonds receive new 4 per cent. bonds and a 25 per cent. bonus in preferred stock. The floating debt of $1,500,000 is to be paid off.

The Outlook For General Electric.

According to calculations by the New York News Bureau the General Electric Company, with its present earnings, will, under the proposed plan, be able to show 6 or 7 per cent. earned on the common stock. The company, as is well known, is doing a business which taxes the capacity of its entire plant. If its net earnings in the year to end January 31, 1899, should increase only 10 per cent. (about the amount of the gain in 1898 over 1897), with the debenture interest payable on only $6,000,000 bonds, the next General Electric report would make an exhibit somewhat like the following:

Net earnings to Jan. 31, 1898		$1,797,246
Estimated 10 per cent. increase		179,724
Net for year ending Jan. 31, 1899		$1,976,970
Other income basis 1898	$389,789	
Less interest on debentures	300,000	
		89,789
Total		$2,066,759
Amount written off 1898	$752,221	
Less profit on securities sold	130,371	
		621,850
Balance		$1,444,909
Preferred stock, 7 per cent		178,584
Balance		$1,266,325
Common stock, 6 per cent		1,096,560
Surplus		$169,765

The surplus, it will be seen, is in excess of 6 per cent. on the preferred stock, which might be devoted toward the cancellation of the back dividends on that stock."

The committee of preferred stockholders will, it is said, oppose resolutely the new plan of adjustment.

Meeting of the Phoenix Carbon Co.

A meeting of the shareholders of the Phoenix Carbon Manufacturing Company, by direction of the Board of Directors, will be held at the office of said company, St. Louis, on August 31st, for the purpose of considering and acting upon a proposition to increase the capital stock of said company from $160,000, the present amount, to $500,000. This increase of capital is rendered necessary by the steady and large growth of the company's business and the very bright outlook for the future.

Mullinix Electric Co.

The Mullinix Electric Company has been organized at Cincinnati, O., to manufacture specialties in the electrical line. The general manager of the new concern, Mr. C. L. Mullinix, was formerly a member of the firm doing business as the Ohio Electric Specialty Manufacturing Company, of Troy, O. He was the designer of the line of woven wire brushes made by that company. The new enterprise will put all Mr. Mullinix's ideas into shape for the market.

THE STOCK MARKET

Midsummer Quietness.

In spite of war, the general business and attitude of the country is peaceful, in the usual midsummer way, when vacations are in order, factories are cleaned up and a certain amount of stock-taking is done. The crop outlook continues excellent, and the farmers are apparently all doing well and buying well. Chicago reports a very large trade in all lines. Our grain exports are still heavy, and exports in general are maintained at a good rate. Bank clearings were 5.6 per cent. larger than in the week of 1897, and 40 per cent. larger tnan in 1894. Railroad earnings for the first half of the year show up finely, the bulk of the traffic being enormous, while economy in management makes the net better all around. Only 5 per cent. of the railroad mileage of the United States is now in receivers' hands, whereas in 1894 it was 20 per cent.

During the week 10,874 shares of Western Union were sold around 93½. General Electric has become more active, 19,527 shares exchanging hands at 39½ to 40. In Boston, on less than 300 shares Bell Telephone, went off 5 points to 275.

Digitized by Google

TRADE NOTES AND NOVELTIES

Wiring the New York State Capitol.

A VERY interesting contract for wiring has just been carried out at the New York State Capitol, Albany, by the E. G. Bernard Company, of Troy, N. Y. The firm undertook to do the job in thirty working days and finished with five days to spare, although ninety days were required by other concerns, and Mr. Perry, the State architect, regarded sixty days as the limit. One of the main features was the drilling of about sixty newel posts of Hallowell granite. Within twenty-four hours after the receipt of the order, the Bernard company had seven steam drills at work, and this task was accomplished in about eighteen days. In each post a vertical hole from 9 to 17 feet long and 2 inches in diameter had to be drilled and to be met exactly by a horizontal hole from 4 to 8 feet long and drilled in a duct hardly large enough for a man to crawl into. The contract included over 7,000 lights. More than 2,000 of these were for lighting the "million dollar" library staircase, over 1,000 going in the dome of the staircase alone, the remainder of the lights being divided in the four approaches and new addition to the State library, with full complement of switchboard, mains, feeders, branches, etc. All wire used on the job was special, so that no standard marketable size could be used for the heavy work. In this installation the Bernard company employed about 75 men, and it was a case of rush from beginning to end. This record is a striking proof of the ability of the Bernard company to handle large and special work in their line in the shortest possible time limit, and there can certainly be no red tape in their management, or work of this magnitude could not be accomplished in so short a time, especially when all wire and other factories were rushed to their utmost capacity with Government orders. The Bernard company claim they could have finished the work in twenty days if standard goods had been specified. They also claim this is the largest and most difficult contract for concealed work in a finished building ever executed in the United States.

Harrisburg Foundry and Machine Company, Harrisburg, Pa.

FEW names of engines are more familiar to the users of steam or to people at all acquainted with street railway and electric lighting power plants than those of "Ide" and "Ideal," two names which have made the manufacturers of these engines both prosperous and prominent. Familiar as these names have been, however, they are about to be surpassed by a third, that of the "Standard," or "Harrisburg Standard," this being the name given to a new engine just brought out by the firm, or, rather, just put on the market, for some of the machines have been running for some time, and thoroughly tested, and have made a record that justifies the claims that are being made for the newcomer. This engine is built on the same general line of the others, and retains all the essential features of the other two, but differs from them as the superlative in language differs from the positive and comparative, so that the names Ide, Ideal and Standard, when compared, read good, better, best.

The main features, however, of this new machine, we are not yet permitted to describe, but it will be illustrated in the course of time. It is enough to know that no cheap material or work enters into its construction, for the same care in workmanship and finish as has been characteristic of all the products of this firm will be exercised in this, and purchasers can feel confident of getting a machine that will last for an unlimited period, and certainly as long as some of the company's older engines, one of which has now been furnishing the power in the company's machine shop for the last twelve years, with little or no attention, except to start and stop it, and with a repair account that is nil. The engines are self-oiling, as the disc with crank pin is enclosed in an oil-tight case and run in a bath of oil, which, by the rotative motion, is forced through pipes to all the bearings of the engine, this being effected without any added mechanism to the engine proper. The new engine will be built to any desired capacity from 8 to 500 h. p., and both simple and cross compound.

The finish and adjustment of the governing mechanism of these engines is of special interest to one at all familiar with the different methods of speed regulation. The fly-wheel type of governor is employed, and the main balance levers are mounted on case-hardened polished pins, with roller bearings, and all the auxiliary bearings are also provided with anti-friction bearings, almost removing friction and making the mechanism unusually sensitive. This governor is centrally balanced and remains so at all points of motion or cut-off, a decided advantage.

The works of the company occupy a tract of eighteen acres on Allison Hill, a height overlooking Harrisburg. The shops comprise four large buildings, known as the machine shop, wood shop, boiler shop and foundry. The tool equipment is very complete, and the labor-saving devices in the way of trolley hoists, cranes and trucks for handling material are numerous and ingenious, among which may be noted a bicycle jib crane, which is guided by a floor and overhead track, which gives a freedom and range of movement that is very remarkable, and makes it a very desirable equipment for any shop. The machine shop is a brick building in the form of a double L, with a boiler and engine room between. The tools of the finishing department, consisting of emery grinders and other tools, by means of which the crank pins, piston rings and other close-fitting parts are polished and gauged, are of peculiar design and economical in operation. Micrometer measurements are made and records and templates kept of all the wearing parts of every machine turned out, so that any piece can be duplicated to replace a worn or broken part, even after a period of twenty years, should an order be received. The products of the firm are not confined to engines, but they build tubular steam boilers of all sizes, and steam road rollers, which include an engine, a boiler and a cab. The tool equipment of the boiler shop includes a very large hydraulic riveting machine and means for handling the large shells. In constructing the boiler the ends of the tube are battered over by hand, and all rivets are finished by hand after coming from the riveting machine, making the work very neat and safe. The company insist that tubular boilers are holding their own against the claims of any other type of boiler in efficiency and economy, and refer to a test of a battery of boilers which they had installed, having Witmeyer settings, and which was made by William Sellers & Co. for some special purpose, and which, under an eleven hour test, showed an evaporation of 13.12 pounds of water per pound of coal from and at 212 degrees. Notwithstanding the magnitude and equipment of the plant as above described, it is the intention of the company to rebuild and enlarge the works in the near future and put in an additional equipment, in order to meet the demands of their growing trade, which is now greatly overtaxing the facilities. Mr. William R. Fleming, formerly the Eastern agent of the company at New York, is now vice-president and general manager at the works, having been induced to accept this position in February last, and is pushing along improvements to keep pace with the increased demand for the new engines and the general products of the concern. They are now building complete plants for six electric railways, besides a large amount of isolated plant work. At this writing they report 47 engine orders undelivered, from which may be gained a fair idea of the volume of business being done in these shops.

Ohio Electric Specialty Co.

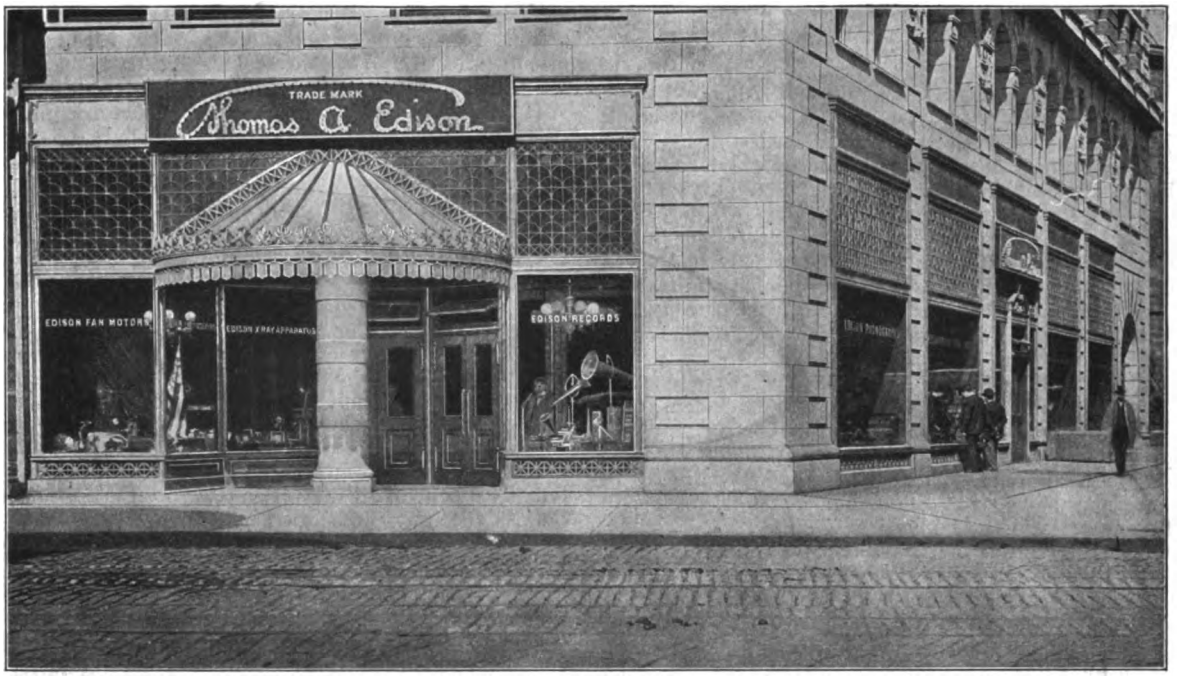
Mr. J. R. Simpson is now the sole proprietor of the Ohio Electrical Specialty Company, of Troy, O., and writes to inform us that it is doing a larger business than ever before in its history. Brushes, rheostats and other specialties of its manufacture have all found favor with the electrical trade throughout the United States and in some foreign countries, and all further orders will be filled with the same promptness and dispatch, all work being guaranteed. Inquiries are solicited.

SUMTER, S. C. The annual meeting of the Telephone Manufacturing Company has just been held and the results reported were so good that the capacity and output of the factory will be doubled. During the year the company has shipped telephones all over the Union, as well as to Mexico, Canada and Central America, and has sold a number of its Imperial long-distance apparatus to the Government.

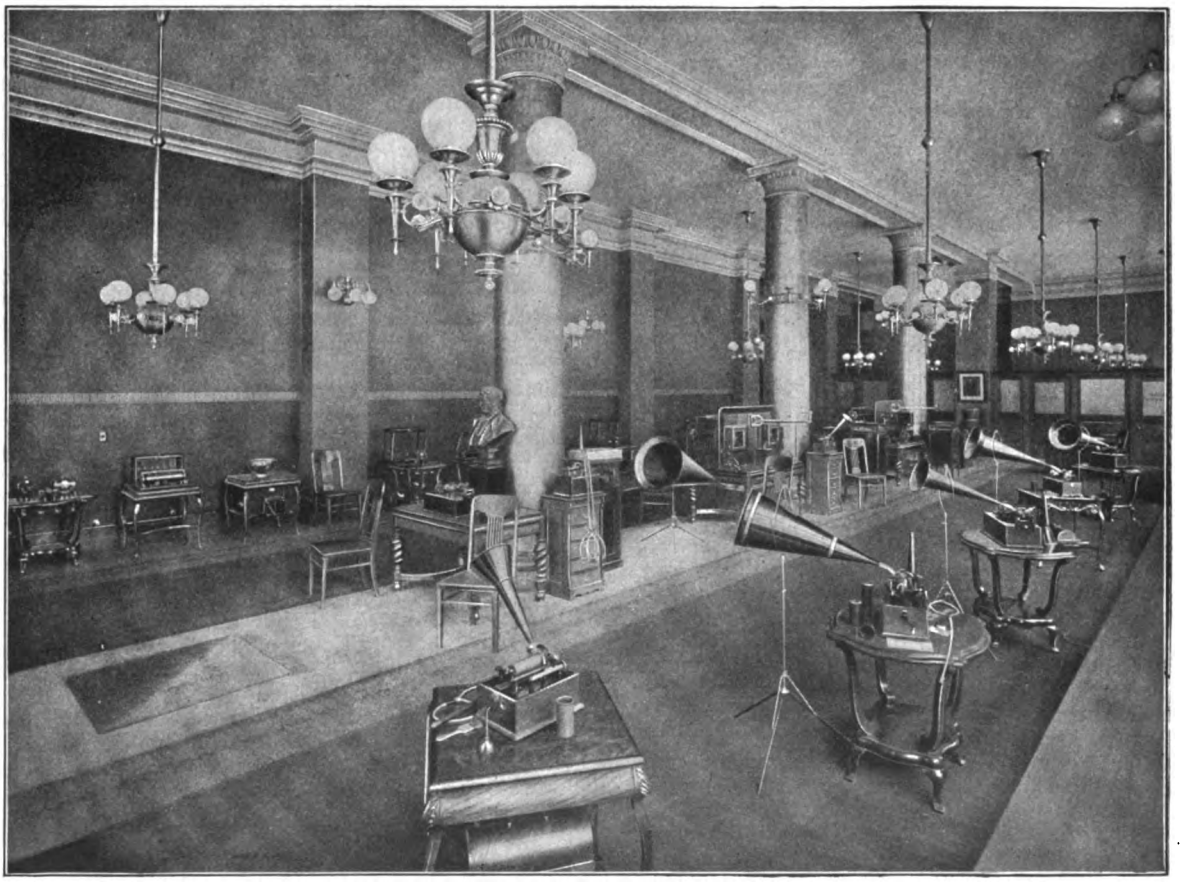
Digitized by Google

The Edison Store on Upper Broadway, New York.

UPPER BROADWAY has no finer modern office building than the St. James, at the corner of 26th street. Its 16 stories tower up above everything in the neighborhood. The ground floor corner store is shown in the picture, and gives one an idea of the pleasing architectural effects which make them a landmark in the uptown shopping district. The facades on both Broadway and 26th street are of light sandstone and red brick. The store itself has a floor space of some 5,000 square feet. Over the front entrance is a graceful glass awning, which together with the broad show windows, makes the lighting as nearly perfect as possible. At night the illumination of the store is a flood of radiance, as befits the company headquarters of one whose name is occasionally mentioned in connection with the electric light. The magic signature is executed on the dark background of the signs over the doors in miniature incandes-



NEW HEADQUARTERS OF EDISON MFG. CO., NEW YORK CITY.



INTERIOR OF NEW EDISON STORE, NEW YORK CITY.

Digitized by Google

cent lamps. Nothing could be more attractive than the exterior, and nothing more satisfactory than the interior. The store is high and broad and long. Down the centre is a row of massive gilded columns. The walls are done in Pompeiian red; the ceilings and cornices are of antique ivory finish. Fittings of polished oak with frosted glass in doors and partitions separate the spacious offices from the main room. The hardwood floors are carpeted with broad strips of Axminster, giving an air of luxury and elegance usually found in boudoir or drawing room, and not looked for in a show room.

Downstairs, the basement is as roomy as the store itself. Under the sidewalks are the wrapping and packing rooms, and also the adjusting and testing departments. There are a number of small rooms fitted up cosily, where buyers of records for their phonographs may hear them undisturbed. A stock of 15,000 makes buying easy; you can always get just what you want. There is also in the basement a fine "dark room," 50 feet long, permitting the proper display of moving picture films for the projecting kinetoscope; and a special show room for X-ray demonstrations, where the wonders of the cathode ray are exhibited, together with all the special apparatus used.

It is worthy of note that the goods displayed do not suffer by reason of their gorgeous setting; for their excellence, perfect finish and high grade, warrant every penny of expenditure in making this place one of the most attractive salesrooms on Broadway. The entire line of Edison phonographs is exhibited, from the most complete and costly down to the popular priced latest invention, the "Standard." Edison fans of various styles and sizes make the hottest, closest day agreeable. All types of the effective Edison-Lalande batteries are shown, while dental motors and a most complete line of electro-medical apparatus are the envy of every doctor or dentist who visits the store to see the very latest developments in the art.

A corps of polite and attentive salesmen are always ready to explain and demonstrate, or to use their arts of persuasion on customers who come prepared to be separated from their money on the basis of lawful and profitable "quid pro quo." Whether buying or looking around, all are welcome, and a visit to this store is already reckoned one of the sights of the metropolis.

Walker Generators for Making Calcium Carbide.

The Walker Company, of Cleveland, O., has secured a large and important contract from the Union Carbide Company, of Chicago, which is said to be the largest order for electric machinery of the alternating type ever placed at one time.

The order consists of twenty 500 h. p. alternating current generators, single phase, 60 cycles, to deliver a current of 2,500 amperes at 200 volts. Besides these, there will be five 100 h. p. direct current generators as exciters, and a complete switchboard for all of these machines.

The spot selected for this mammoth plant, which is to be run entirely by water power, is at the falls of the Soo at Sault Ste. Marie.

The Union Carbide Company has acquired rights of manufacture of calcium carbide for the United States and will have its main works at Sault Ste. Marie. The carbide is at present manufactured at Niagara Falls, the electric power necessary being supplied by the Niagara Falls Power Company. The output of the Niagara plant is about ten tons per day, while that of the works at the Soo will be 100 tons per day. The works are to be built for the accommodation of forty generators and forty electric furnaces, where the lime and carbon are fused into calcium carbide, the twenty generators in this first contract being but the initial order.

Recent Shipments By M. C. Bullock Mfg. Co.

We give below a list of recent shipments from the works of the M. C. Bullock Manufacturing Company, 1170 West Lake street, Chicago, including only the larger orders. The concern reports that business has been gradually and steadily improving for the past half year, so that the total shipments for the month of May aggregate larger than those of any month since the financial crash of 1893. Machinery business and that of mining in particular they find excellent. The orders are:

One 4 ft., two 6 ft. and one 8 ft. Champion mine ventilating fans to Japan. One "Detector" diamond prospecting drill, with complete outfit to bore and remove cores to a depth of 2,500 feet, shipped to Montana. One "Chief" diamond core drill, with complete outfit for removing a 2-inch core to a depth of 1,500 feet, for use in the Siberian gold mines of Russia. To the Metropolitan Iron and Land Company, of Ironwood, Mich., a "high-class" first motion hoisting plant, consisting of a pair of 24 x 48 Bullock-Corliss engines, with two cast-iron shell drums, 8 ft. diameter by 9 ft. face, each winding 2,075 feet of 1¼-inch steel wire rope. This plant is fitted with an auxiliary steam actuated handling motion, containing all recent refinements and improvements to insure safety and ease of manipulation. This is the fourth hoisting plant furnished to the above company by the Bullock Manufacturing Company. This fact speaks volumes for the character of the work turned out by this firm.

Chloride of Silver Dry Cell Battery Co.

THE principal products of this firm, as the name implies, are batteries, composed of chloride of silver dry cells, designed chiefly for use by physicians and dentists, and are known as medical batteries. Both the galvanic and faradic types are manufactured, and as accessories a very large assortment of electrodes are made.

This type of battery until recently has been employed almost entirely in medical practice, but now they are being used by electric lighting, telephone and street railway companies for the testing of cables and conduit wires. These batteries on account of their compactness and lightness are especially adapted for use in subways and out-of-the-way places where it is difficult to use large testing instruments, and to this class of trade the manufacturers are now catering. The principal claims made for this type of cell are its extreme lightness, durability, a constant potential throughout the life of the battery and mechanical construction and finish.

The individual cells are extremely small, being less than an inch in diameter and a trifle over 3 inches in length, including the brass tube in which each cell is encased, and weigh only about 2 ounces; they are made to an exact gauge, so that the cells may be readily replaced, and as may be inferred, a 50-cell battery can be mounted in a small case which can be easily handled. No liquids or acids are used in the manufacture, so that each cell is practically dry, being hermetically sealed, and then enclosed in a close fitting brass tube, so that a battery can be carried in any position without a possibility of leakage. The composition and construction are covered by numerous patents. The tension of each cell is one volt. Each cell has an actual working life of 700 hours and gives a constant electromotive force during its entire life, which is measured only by the actual demand made upon it, there being no chemical action when the circuit is not closed, so there is practically no limit to the time the batteries will last, and many that were put in service ten years ago are reported still as being in good working condition. The price of each cell is 90 cents, but the cells when exhausted may be returned to the manufacturers for which the company allows 60 cents, as the silver element, which the cell contains is valuable, and can be refined and used again. By this arrangement cells can be accepted in exchange for new ones at two-thirds the original price. The rheostat employed with these batteries is of special design, and known as the Willms' current controller; it consists of a circular disc about 6 inches in diameter, mounted on a metal base, and having on its face a hard rubber plate, perforated around the edge with contact pins, which connect with the graphite resistance placed between the rubber and base. The switch arm is pivoted in the middle, and as it swings around it gradually cuts out the resistance; the range being from less than one ohm to a maximum of 200,000 ohms. Controllers of this type are also calibrated, showing the amount of resistance at each contact point.

This firm, of which Manes E. Fuld is general manager and H. S. Shepard superintendent, have been in the business about fifteen years; their office and works are located at 409 Paca street, Baltimore, Md., where they occupy two buildings, extending through the block. The power for operating the machinery is supplied by a 50 h. p. gasoline engine, and the different departments are well equipped with the necessary metal and iron working tools. There is also a nickel-plating department, buffing wheels and ample storage and packing space. Light and dark mahogany are the woods chiefly employed for cases and

Digitized by Google

cabinets, and in all cases the cabinets are richly finished. About fifty hands are employed, and the products go to all parts of the world, China and Japan being liberal customers.

CATALOGUES.

The Reliable Electric Mfg. Co.'s Telephone Apparatus.

A VERY complete and interesting catalogue has just been issued by the Reliable Electric Manufacturing Company, of Worcester, Mass., manufacturers of telephones, supplies and electrical specialties. The company make a specialty of high grade telephone apparatus. Their transmitter is claimed never to get out of order and yet is so delicately adjusted that the slightest sound can be distinctly heard, and at the same time it gives perfect articulation. It has been thoroughly tested for long distances and general use and has received the highest testimonials. Their complete telephone set No. 1 is intended for exchange and long distance use and is provided with their patented granular transmitter, a 15,000 ohm generator, powerful ringers and their double-pole receiver. The set is ornamental, as well as useful, and special finish and workmanship have been laid out on this instrument. Set No. 2 is intended for every class of service, and especially for intercommunicating systems. Set No. 3 is a battery call set for offices and other places where a nicely finished instrument is required. Set No. 4 is a combination desk set with switch arrangement in the base. This consists of an aluminum globe surmounted by a bronze eagle, which holds the telephone set and is adjustable in any position. Set No. 5 is a desk set with the transmitter adjustably mounted and equipped with a double-pole receiver. Set No. 6 is a combination transmitter and receiver. The company's receiver is one of the most powerful manufactured, and consists of a hard-rubber handle and bottom piece, nickel-plated brass case, silk-wound spools and double-pole magnets strongly magnetized. Set No. 7 is a high-grade instrument, without the costly finish given to set No. 1 and is furnished with a standard Bell receiver. Set No. 8 is intended for private lines and interior work in factories, warehouses and large stores. Set No. 9 is a battery call set fitted with their granular transmitter and a standard Bell receiver. All these sets are illustrated, and their prices given in the catalogue, which also contains numerous illustrations of other electrical specialties. The catalogue will be sent to anyone on application, and all questions relating to these goods will be cheerfully answered by the Reliable Electric Manufacturing Company, 86 Foster street, Worcester, Mass.

ADVERTISERS' HINTS.

THE MUNICIPAL COUNCIL of Shanghai, China, advertise for proposals for furnishing two 100 k. w. alternators direct coupled to medium speed engines and for switchboard and instruments and a water tube boiler.

THE GENERAL ELECTRIC COMPANY call attention to the ease with which their enclosed arc lamps may be trimmed.

THE GARVIN MACHINE COMPANY, Spring and Varick streets, New York, offer shapers in all sizes and styles. They have a large stock for immediate shipment.

THE K. & W. COMPANY, Pittsfield, Mass., say that sustained candle power is the strong point of their lamps.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY devote their space to the type "C" Tesla polyphase induction motor.

KENT ELECTRIC MANUFACTURING COMPANY, Worcester, Mass., are supplying drum armature battery fan motors at $6.00. They carry a 10-inch fan.

THE PELTON WATER WHEEL COMPANY, New York and San Francisco, have installed 9,000 wheels, which aggregate some 700,000 h. p.

THE BURTON ELECTRIC SMELTING COMPANY, Boston, Mass., suggest to central station managers that they introduce the Burton electric forge, which will be found to fill a long-felt want in many fields of manufacturing.

NEW YORK NOTES.

MULTIPHASE WIRE. The Suburban Underwriters' Association, New York, has increased the rebate allowed for the automatic fire alarm system to 10 per cent. when the boxes are connected by means of the Montauk "Multiphase" wire, which has already made so favorable an impression on the electrical and insurance public.

BRUSH ELECTRIC COMPANY, through General Manager Hamill, reports the sale of 12 125 arc lighters to the Buffalo General Electric Company and states that it is busy on a variety of orders.

CONTENTS.

EDITORIALS:
Sault Ste. Marie as an Electrical Centre 34
Signs of the Trolley Times 34
Progress in Electro-Metallurgy 35
ELECTRIC LIGHTING:
A Few Interesting Pointers Concerning Enclosed Arc Lighting (Illustr.) ..... J. H. Halberg 25
The Northern Electric Company of Baltimore, Md. 26
ELECTRIC TRANSPORTATION:—
The Waterloo and City Underground Electric Railway, London (Illustr.) 27
TELEPHONY AND TELEGRAPHY:
The Evolution of the Telephone Line Signal—II. ..... Arthur Vaughn Abbott 28
The Chesapeake and Potomac Telephone Company, Baltimore Md. ..... C. B. Fairchild 29
Practical Features of Telephone Work—XVII. ..... A. E. Dobbs 31
Overhead and Underground Telephone Work, Stockholm, Sweden (Illustr.) 32
POWER TRANSMISSION:
The New Veeder Cyclometer Factory, Hartford, Conn., Electrically Operated (Illustr.) 32
EDUCATIONAL:
Work of the Electrical Engineer Institute of Correspondence Instruction 33
MARRIED:
Brayton—Wait 35
SOCIETY AND CLUB NOTES:
American Institute of Electrical Engineers.—Eighth Annual Meeting of the Canadian Electrical Association.—New York Electrical Society 35
MISCELLANEOUS:
Alternating Current Transformers from the Station Manager's Viewpoint ..... W. F. White 36
Silver Plating Plant at the Hotel Metropole, New York.—Prof. Andrew Jamieson's Suggestions Regarding the Conventional Electrical Diagrams (Illustr.) 37
ROENTGEN RAYS:
The Fessenden X-Ray Apparatus (Illustr.) 38
PERSONAL:
Reminiscences and a Glimpse into the Future.... Prof. Elisha Gray 38
Mr. H. G. Issertel.—Lieut. Wood 39
MECHANICAL:
The Skinner Automatic Engine and Improved Lubricating System (Illustr.) 39
Purification of Boiler Water.—A Chimney That Had Outlived Its Usefulness (Illustr.) 40
NEWS AND NOTES:
Street Railway Receipts in 1896 and 1897 41
Illumination of the Grand Canal, Omaha Exposition (Illustr.).—Electric Traction on an Ohio Canal.—A New Application of Hertzian Naves.—Production of Electrical Energy by the Direct Action of the Atmosphere.—Engineering Education 42
INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents Issued June 28, 1898. 43
Classified Digest of U. S. Electrical Patents Issued July 5, 1898... 43
REPORTS OF COMPANIES:
Nassau Electric Railway Readjustment.—The Outlook for General Electric.—Meeting of the Phoenix Carbon Co.—Mullinix Electric Co. 44
THE STOCK MARKET:
Midsummer Quietness 44
TRADE NOTES AND NOVELTIES
Wiring of the New York State Capitol.—Harrisburg Foundry and Machine Company, Harrisburg, Pa.—Ohio Electric Specialty Company 45
The Edison Store on Upper Broadway, New York (Illustr.) 46
Walker Generators for Making Calcium Carbide.—Recent Shipments of the M. C. Bullock Manufacturing Company.—Chloride of Silver Dry Cell Battery Company 47
The Reliable Electric Manufacturing Company's Telephone Apparatus.—New York Notes.—Advertisers' Hints.

Department News Items will be found in advertising pages.

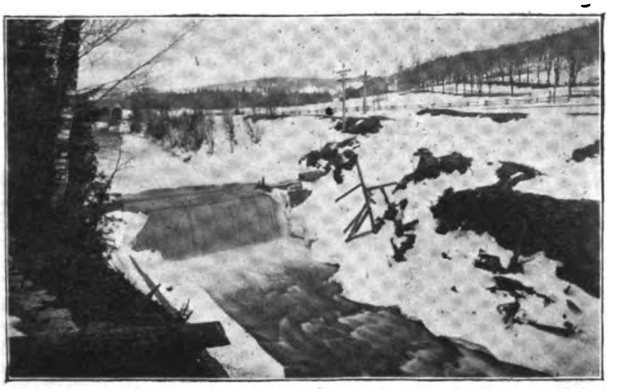
Digitized by Google

The Electrical Engineer.

Vol. XXVI. JULY 21, 1898. No. 533.

A Fourteen Mile Transmission at Barton, Vt; With Monocyclic Apparatus.

FOR the past two years the village of Barton, Vt., has been enjoying the benefits of cheap electricity brought to it by the Barton Electric Light and Power Association, from a water power situated fifteen miles distant at Charleston, Vt. Within



STONE DAM AND WOODEN TUBE, PLUNKETT'S FALLS, VT.

recent years Barton has been undergoing a steady process of growth, incident to the location within its limits of several large manufacturing concerns, and the increase of population which these have brought in their train. About two years ago it was felt that the town had reached the condition in which electric

GENERATING STATION, PLUNKETT'S FALLS, CLYDE RIVER, VT.

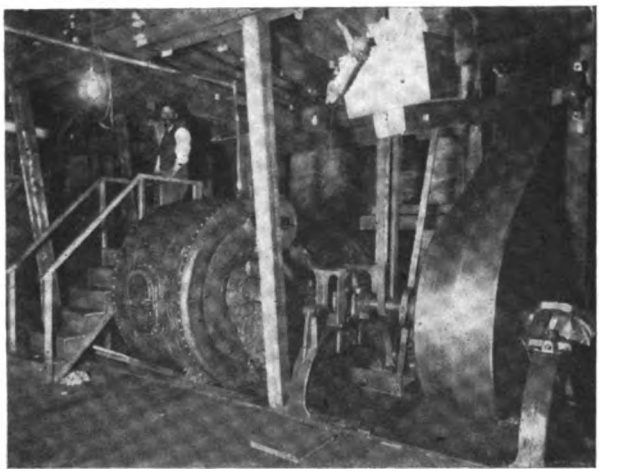
lighting had become a necessity, and the project took form by the appointment, by the townspeople, of a committee to investigate the matter and report. The question was very thoroughly examined and discussed, and every system canvassed. One mile east of West Charleston village on the Clyde River, is a water power known as Plunkett's Falls. This seemed to the committee a very suitable source of power which might be utilized in connection with the electric lighting project, and it was secured at a reasonable figure. At the next village meeting it was voted to build a plant and to locate it at Plunkett's Falls. The trustees were empowered to bond the town in accordance with an act of the Legislature and to proceed with the work.

The power site is admirably suited to electric generation purposes. The stream is large, the flow comparatively uniform and with only ordinary precaution little danger of shut down is likely to occur from ice or freshets. The entire fall of water, 76 feet, is utilized.

A masonry dam 75 feet long was thrown across the river at Plunkett's Falls and from this to the power house forebay a flume or wooden pipe line, 1,000 feet long, was laid, 700 feet of which is laid upon a rock ledge along the Clyde gorge above the stream. The wooden pipe is built of heavy planking tongued and grooved and held together by heavy iron bands. The hydraulic work was carried out by G. W. Buzzell.

The system of generation and transmission adopted is the monocylic system of the General Electric Company. The use of this system for a transmission of power over so great a distance is extraordinary and this is the only instance in which it has been employed. It has, however, been successfully operated without accident or difficulty since the day the plant was started.

The power house is a frame building standing on a rock ledge



LEFFEL WHEEL, GENERATING STATION, CHARLESTOWN, PLUNKETT'S FALLS.

near the stream, about one mile from Charleston village. It is divided into three parts, the lower or turbine chamber, the dynamo and switchboard room and the living room of the station attendant above the dynamo room. The turbine is from the works of the James Leffel Co., of Springfield, O. It runs at 350 revolutions per minute and is rated at 500 h. p. The dis-

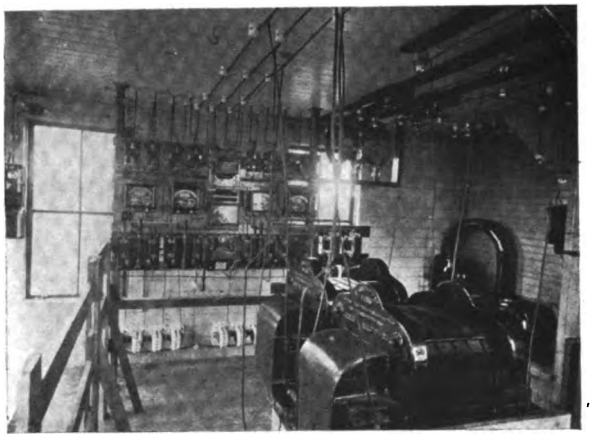
GENERATING PLANT, CHARLESTOWN, PLUNKETT'S FALLS.

charge water passes into a tail race 200 feet long below the power house. The turbine is belted to two General Electric monocyclic alternators set up on the first floor. These are eight-

Digitized by Google

pole machines, each of 100 kilowatt capacity, delivering current at 1,040 volts at a speed of 900 revolutions per minute.

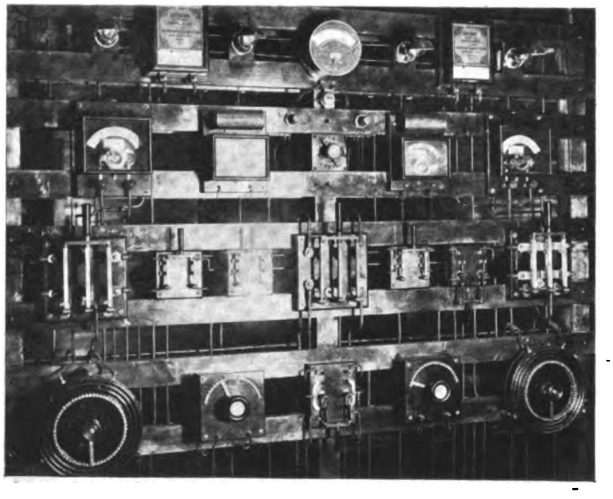
These alternators are simple single-phase generators differing slightly from the standard single-phase type, in the armature, which is provided with a small additional winding known as a "teaser" coil. By means of this coil an out-of-phase electromotive force is furnished for the purpose of starting motors.



INTERIOR OF SUB-STATION, BARTON, VT.

The monocyclic system is, however, essentially a single-phase system and practically all the energy is carried over two wires. From these the lighting system is supplied in the usual manner. The induction motors require a third or "power wire," but this is run only to points where motors are to be installed. Thus the lights are operated on a single-phase system, while the motors operate as on a multiphase system. In the monocyclic system unbalancing is impossible.

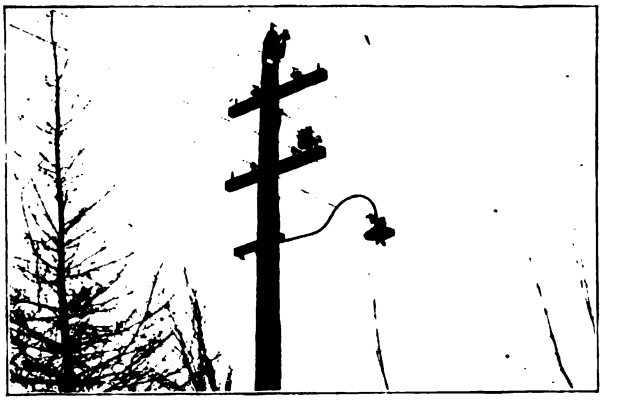
The armatures of these machines are of the ironclad type and the coils are formed and insulated before application to the core. They are held in place by insulating blocks and no binding wires are used. The armature is thoroughly ventilated, and built up of thin sheets of steel of high magnetic permeability. The frame is in two parts, the lower being the base, lower magnet yoke and the pillow blocks; the upper part being the upper magnet yoke. The pole pieces are made up of steel laminations cast into the yoke, and the field coils are wound on insulated removable spools. The machines run cool and



MAIN SWITCHBOARD, GENERATING PLANT.

regulate automatically. Each machine occupies a space of 6 ft. 8 in. long by 6 ft. 2 in. wide.

The switchboard is of the wooden skeleton type and all wires to and from it are carried underneath the floor. The step-up transformers are of the air-blast type and are four in number each of 40 kilowatt capacity. In these the initial pressure is raised, and the current passes to the transmission lines at 5,720 volts. One illustration shows a pole head near the entrance of the line into Barton. The topmost insulator supports an iron barbed wire grounded at intervals and acting as a lightning arrester. The next three insulators arranged in a triangle are of the porcelain double petticoated type, and carry the three



POLE LINE, ENTERING TOWN OF BARTON.

main transmission wires of No. 4 B. & S. gauge. The next three are of glass and carry the secondary mains from the substation. The two lowest carry the telephone wires.

The substation at Barton is a small frame building carrying

SUB-STATION, BARTON, VT.

a tower into which the main transmission lines are brought and connected through G. E. alternating current lightning arresters to step-down transformers, each of 40 kilowatt capacity, also of the air-blast type. These are cooled by two 12-in. Sturtevant

EXCITERS AND WATER WHEEL GOVERNOR, CHARLESTOWN.

blowers—one coupled directly to an overshot water motor driven by water from the Barton water system, the other coupled directly to a 1 h. p. induction motor served from the long dis-

Digitized by Google

tance transmission lines. There are thus two methods of ventilating the transformers, but ordinarily the water motor only is in use, the electric motor being called upon in case of emergency. The transformers reduce the pressure of the current to 1,040 volts, at which pressure it is distributed over a system of feeders to smaller transformers, in which the pressure is again reduced to 113 volts.

The service network is laid out on the Edison three-wire system, and all current is supplied to customers through Thomson recording wattmeters. The lighting of the streets is effected by groups of two 16 candle power incandescent lamps, under a small reflector hood, located at short intervals along the streets and highways. They are directly connected to the secondary, three-wire Edison, network. This system of lighting was adopted because it allowed the use of one type of lamp only for all lighting purposes in Barton. Furthermore, the chance of both lamps failing is very greatly reduced, and as a matter of fact inspection of the street lamps is made once a week only. The number of 16 candle power lamps wired for residential and street lighting is 2,000.

The cost of operating this plant is, we are assured, exceedingly low, while the service rendered is highly satisfactory. The transmission line is carried also to the town of Island Pond, Vt., 12 miles away, where about 800 lights are supplied with the necessary current. The committee under which the project was started was made up of Messrs. C. P. Percival, Geo. H. Davis and J. W. Murkland. The general superintendency of the work was vested in the town trustees E. G. Colliston, H. T. Seaver and E. F. Dutton. The resident engineer, who superintended the details of the work, was Mr. Ernst Gonzenbach.

The Glascow, Scotland, Municipal Lighting Plant, Port Dundas.

WE illustrate herewith in some detail the plans for the new Port Dundas plant of the Glasgow municipality, which will contain a good deal of American apparatus. These plans have been prepared by Mr. W. A. Chamen, the electrical engineer of the corporation, and the building was designed by Mr. Andrew Myles, in consultation with him. The portion of the building now being proceeded with is in the centre, and measures some 220 feet long. It will be capable of containing plant

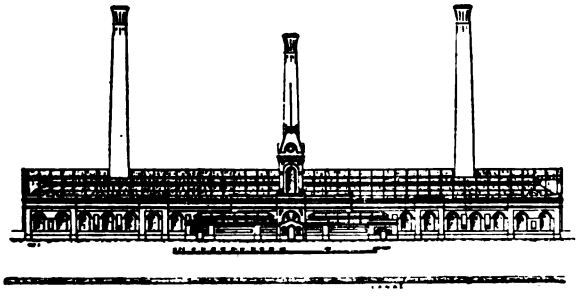


FIG. 1.—ELEVATION OF GLASGOW MUNICIPAL LIGHTING PLANT, PORT DUNDAS.

equal to an output of 10,000 indicated horse power. The whole building, when ultimately completed, will be capable of containing plant equal to an output of 30,000 indicated horse power. The plant at present to be installed in these buildings consists of two Babcock and Wilcox boilers of about 1,100 h. p. each, carrying about 200 lbs. steam pressure and fitted with automatic stokers of the chaingrate type; one triple-expansion vertical engine of 900 indicated horse power, made by Messrs. Matthew Paul & Co., Limited, of Dumbarton, directly coupled to multipolar dynamo by Messrs. Shuckert & Co., of Nurnburg, furnished by Messrs. Mavor & Coulson, Glasgow. One compound vertical engine of 750 indicated horse power by the Ball & Wood Company, directly coupled to two dynamos by the Walker Manufacturing Company, the contract for this being in the hands of Messrs. Laing, Wharton & Down, of London. One 400 h. p. triple-expansion vertical engine by Messrs. Mirlees, Watson, Yaryan & Co., Limited, and one 200 indicated horse power compound vertical engine by the same makers, each being directly coupled to dynamos by Messrs. Crompton & Co., Chelmsford, the contract for these two sets being in the hands of Messrs. Mirlees, Watson, Yaryan & Co., Limited.

The Forth and Clyde Canal lies at a considerably higher level than the engine room floor, and the ground falls away rapidly from the canal to the roadway. Although this necessitates dif-

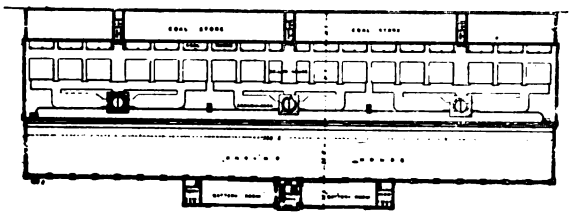


FIG 2.—PLAN OF PORT DUNDAS PLANT.

ferent levels for the floors of the coal store, boiler house, engine room and battery room, it offers advantages in the supply of fuel. The coal will be brought in by canal and lifted by the Temperley transporter direct from the barges, and deposited either into the coal store or into weighing hoppers placed above the coal tanks on the top of the wall between the coal store and the boiler house. From this tank it can be shot either into the coal store or into the hoppers of the automatic stokers, along the boiler fronts. The ashes from the boiler furnaces are delivered into a tunnel or subway running from end to end of the boiler room and arranged so that shallow trucks can receive the ashes and carry them to the ends, where they can be lifted and shot into carts or otherwise disposed of.

There will be only one line of boilers, each unit of which will be of about 1,100 h. p. There is a space behind the boilers

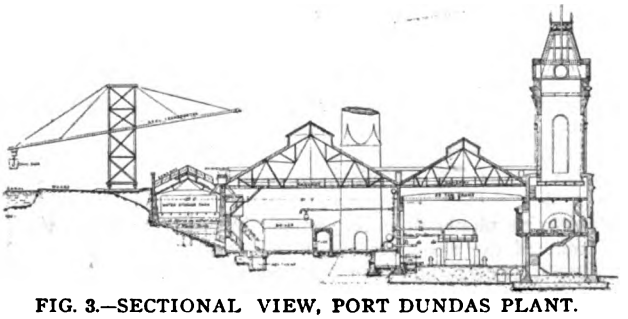


FIG. 3.—SECTIONAL VIEW, PORT DUNDAS PLANT.

sufficiently large to take economizers, the three chimneys dividing the space into four lengths. Two of the chimneys will be at least 230 feet high and 13 feet in diameter, and the centre one 200 feet high and 11 feet in diameter. All steam pipes will be as far as possible in the boiler room, and there will be no ring main of steam pipe entailing the use of large valves which are so troublesome to keep tight. Arrangements will be made so that the main steam pipe can be relieved of all pressure at certain times without stopping the station.

The engine room is about 57 feet in width and is spanned by a traveling crane capable of carrying 25 tons, so that it will be capable of dealing with sets of plant up to 2,500 h. p. in size. Next the wall of the boiler house is a trench along which water tanks on weighing machines can be run for the purpose of measuring the condensed steam from the air pump of any engine which may be under test. All the large sizes of engines will be fitted with separate surface condensers, having the air pumps either driven directly by rocking shaft and connecting rods or by electric motors. The cooling water will be taken from the canal at one end of the engine house and returned to it at the other, the necessary pumps for overcoming the pipe and condenser friction being of the centrifugal type and driven by electric motors. Owing to the position of the canal very little power should be required for forcing the circulating water. On the left-hand side of the engine room tunnels are provided for the cables to and from the dynamos, switchboards and feeders.

Digitized by Google

The roofs of both engine and boiler rooms will be entirely of iron and glass so as to give ample light.

Next to the engine room comes the battery room, which is divided in the middle by the entrance under the tower containing the station engineer's office, etc. An important feature of the design is that the station engineer's office has in it a bay-window projecting into the engine room, so that he can see from end to end of it without leaving his room. By means of a spiral staircase he can also obtain access to a gangway overhead, which passes across the engine room above the level of the traveler and thence also across the boiler house, so that he can, with the minimum amount of walking and in the shortest possible time make an inspection of the whole premises.

Two-Wire Distributing Systems and Lamps, 200-240 Volts.[1]

BY JOHN W. HOWELL.

DISTRIBUTING systems, operating at 200-240 volts with simple two-wire circuits, first attracted attention about four or five years ago. These early plants used two 110-120-volt lamps in series and were installed as a means of competing in cost of installation with three-wire plants without resorting to the alternating current system, with its disadvantages where motors are operated. The growth of these plants was slow until the demand created by them led to the production of the 200-240-volt lamp and practical experience had shown the weakness of these lamps and led the makers to overcome the difficulties met in their manufacture.

These defects have been entirely remedied, and the experience of many plants operating 200-240-volt lamps during the past year proves these lamps to be just as reliable in service as are 110-volt lamps. The development of the lamp has taken considerable time, and the growth of the 200-240-volt two-wire system in spite of the shortcoming of the early lamp is due to compensating advantages in other elements of the system.

These advantages over the three-wire system are: (1) cheapness of installation and (2) simplicity of operation.

1.—Cheapness of installation of the 200-240-volt two-wire system, when compared with the 110-120-volt three-wire system, arises from the use of a single large dynamo where the three-wire system requires two, each having half the capacity; with the accompanying duplication of regulating apparatus, indicators, ammeters, etc. There is also a saving of the entire cost of the neutral conductor of the three-wire system, which conductor in street mains (as distinguished from feeders) and in house wiring, should be as large as the outside wires.

Three-wire plants in cities, whose business warrants the employment of the skill necessary to operate the system to best advantage, successfully use 110-120-volt 3.1 watts per candle lamps and get very excellent results from them. The 200-240-volt two-wire system cannot be considered a competitor of the three-wire system under these conditions since the best 200-240-volt lamp on the market to-day is a four watts per candle lamp. But it is my opinion that in smaller installations, whose conditions call for a 3.5 watts per candle lamp when a 110-120-volt three-wire system is used, the advantages of the two-wire 200-240-volt system are sufficient to offset the disadvantages of a 4 as compared with a 3.4 watts per candle lamp. Under normal conditions the performance of the present four watts per candle 200-240-volt lamp as regards life and maintenance of candle power is about 25 per cent. poorer than the present 3.5 watts per candle—110-120-volt lamp, but it is my opinion that the greater irregularities in pressure ordinarily found in the three-wire plants we are now considering, as compared with the two-wire plants operated under similar conditions, fully counteracts, by its injurious effects upon the lamps, the advantage in life and candle power which the 110-120-volt 3.5 watts per candle lamp has under normal conditions over the 200-240-volt four watts per candle lamp.

In considering the relative advantages of the two systems, in the case of moderate sized plants above referred to, we must charge against the saving effected in a two-wire plant by its single equipment and omission of the neutral conductor, the increased capacity of machinery and conductors made necessary by a four watts per candle as compared with a 3.5 watts per candle lamp.

Considering the copper required by a 220-volt two-wire system using four w. p. c. lamps as our unit, the copper required by the two outside conductors of a 110-volt three-wire system using 3.5 w. p. c. lamps will be .875. The amount to be added to this for the neutral conductor will vary somewhat with location of the station with reference to the points of consumption. If we assume that one-half the copper is installed for feeders and one-half for the distributing mains, and that the neutral wire is one-third the size of the outside wire in feeders and the same size in mains, then the total copper in the neutral conductors of feeders and mains will be 29 per cent. of the amount used in the two-wire 220-volt system, and the total copper used in the 110-volt three-wire system will be 16 per cent. greater than the copper used in the 220-volt two-wire system. This comparison of the costs of copper does not consider the cost of wiring customers' premises, which is usually borne by the customer; it is, however, an advantage to the 220-volt system that this wiring will require at least 20 per cent. more copper for the three-wire 110-volt system than for the 220-volt two-wire system.

The 4 w. p. c., as compared with the 3.5 w. p. c. lamp, would require for the 200-240-volt two-wire system, one-seventh greater capacity of boilers, engines and dynamos than would be required for the three-wire 110-120-volt system.

The duplication of apparatus required for the three-wire system will only partly offset this increased cost in the two-wire 200-240-volt system, but the cost of this duplication of apparatus, together with the increased cost of copper required, will in many cases make the cost of installation of the three-wire system at least equal to that of the 200-240-volt two-wire system, leaving the simplicity of operation of the two-wire system to be balanced against the increased cost of fuel required to operate 4 w. p. c., as compared with 3.5 w. p. c. lamps.

During the time the plant is operated considerably below its rated capacity, which will probably cover even the maximum load during the first year of the plant's existence, and all but three or four hours per day at all times, I think the increased fuel consumption due to 4 w. p. c. lamps will not be appreciable because of the poor efficiency of boilers and engines with light loads, and the total increased consumption of coal during the year will, I believe, be a small consideration under most circumstances, and in my opinion not enough to balance the simplicity of operation above noted.

A few months ago I made a trip through some of our central States, visiting a number of 200-240-volt plants to get a knowledge of the practical workings of the systems from the persons actually operating them, hoping to get from their experience, information concerning existing conditions which would be of value in the lamp factory.

Naturally, my first questions to the man who operated the plant concerned the lamps; were they generally satisfactory? were they long lived? did they ever explode? I was greatly pleased with the answers I received. The lamps were reported to be almost universally satisfactory. They were very long lived, in fact too long lived, for better service would be rendered if the lamps were renewed when they began to get dull, and not allowed to remain in service after they ceased to give a first-class light.

These 4 w. p. c. 200-240-volt lamps may be used for 600 hours and still give a good light, but I think this is about the limit of their useful life. If not taken in they will keep on burning for a long time and will give an average life of over double that figure before breaking.

The reports concerning exploding were equally satisfactory. For the past year or more, exploding lamps had been practically unknown; previous to that time, however, this had been one of the most serious objections to the system.

All these plants have been installed with switches, cut-outs, and other appliances made for 110-120-volt installations, and it is remarkable how little trouble has been caused by them.

Sockets.—Ordinary key sockets have been freely used and experience has shown the Edison screw socket and lamp base to be preferable to other types. Some engineers recommend keyless sockets and good snap switches, to avoid possible failure of the key socket to break the circuit.

In order to get the desired factor of safety, the General Electric Company has recently developed a special key socket for this work, having a break gap twice as great as the sockets designed for 110-120-volt systems, and having a fibre insulating lining between the outside shell of the socket and the screw shell which is connected with the circuit. This fibre lining projects

[1]Read before the 15th General Meeting of the American Institute of Electrical Engineers, Omaha, June 27th, 1898. Abstract.

Digitized by Google

sufficiently beyond the screw shell to prevent contact with the circuit when the lamp is in the socket. The lamps are provided with short bases designed to be completely covered by this fibre lining, so it is impossible to get a shock by touching the lamp when it is burning.

Flexible Cord.—Flexible cord has been freely used, and is all right if the best quality is used. For this purpose the conductors should be covered with rubber 1-32 inch thick and the outside covering should be silk, or if cotton it should be slicked with a compound which makes it non-inflammable.

Rosettes.—Rosettes designed for 110-120-volt circuits having fuses, have given a good deal of trouble, so it has become good practice to leave out the fuse wire and put copper wire in its place, thus having no fuse between the lamp and the fuse block close to the switch controlling the circuit.

The General Electric Company has produced a new porcelain rosette which has fuse wires over one inch long; these have been severely tested with very satisfactory results. Their use with fuses will give protection to individual lamps, which is very desirable, as it increases the safety of the wiring.

Cut-Outs.—Fusible cut-outs designed for 110-120-volts, have failed in many instances, and have often proved much more fusible than their makers expected them to be. A complete line of fuse blocks carrying special 200-240-volt fuses has been developed recently by the General Electric Company.

Switches.—Standard knife switches or quick-acting snap-switches having large break distances, should be used. Such switches specially designed for 200-240-volt installations are now being developed.

Wiring.—Standard methods of wiring for 110-120-volts are approved for 200-240-volts. Good rubber covered wire run on porcelain knobs or cleats is specified by the fire underwriters.

Arc Lamps.—Good arc lamps burning two in series on 220-volt circuits are on the market. Each lamp is provided with an automatic cut-out which throws an equivalent resistance into the circuit when one lamp is extinguished, thus permitting the use of one lamp if desired.

Future.—The future of the 200-240-volt system depends largely upon the development of a more economical lamp. All other elements of the system can be made entirely satisfactory with the means and knowledge now at our command, but the production of a more economical lamp calls for an advance in the art of lamp manufacture. That this advance will be made and a more economical lamp will be produced, I have no doubt, and hope to see such a lamp placed upon the market at an early date.

The Hull Alternating Arc Light Regulator.

MR. D. A. HULL, superintendent of the Port Clinton, O., Electric Light and Power Co., has recently secured a patent for a device for producing and regulating a constant current suitable for operating alternating current arc lamps in series.

The regulator illustrated in perspective in Fig. 1, consists of

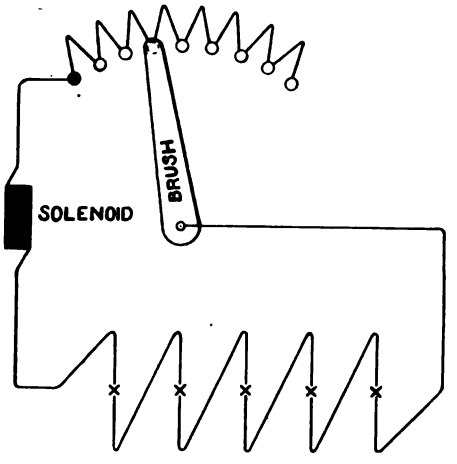


FIG. 2.

an auto-converter connected across the mains, as shown in the diagram, Fig. 2.

The solenoid shown in the upper right hand corner of the engraving (Fig 1) is in the circuit with the lamps to be controlled. It has under its control the induction motor which is cut in and out, and reversed according to the conditions of the circuit to be controlled. This motor operates the brush on a

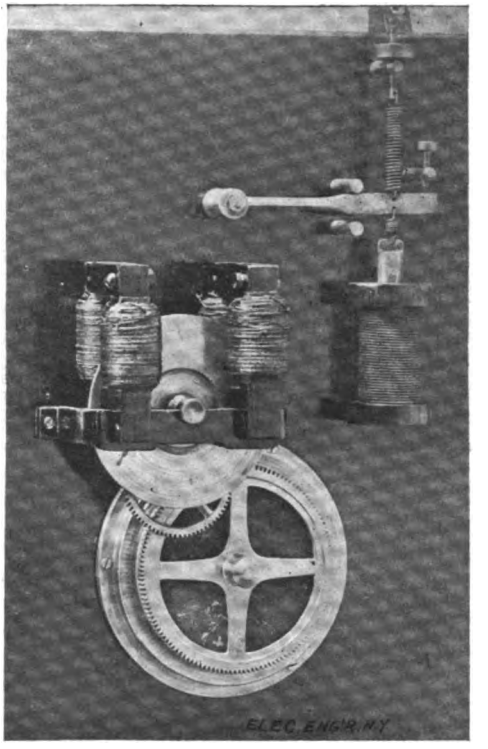
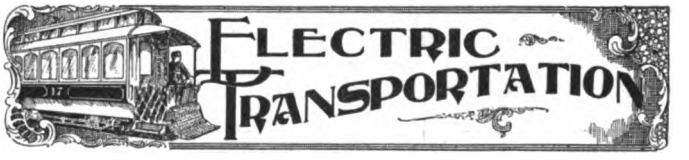


FIG. 1.—HULL ALTERNATING ARC LIGHT REGULATOR.

series of contacts, which are connected with the leading out wires from the auto-converter located on the opposite side of the machine.



Storage Battery Plant of the Buffalo Street Railway.

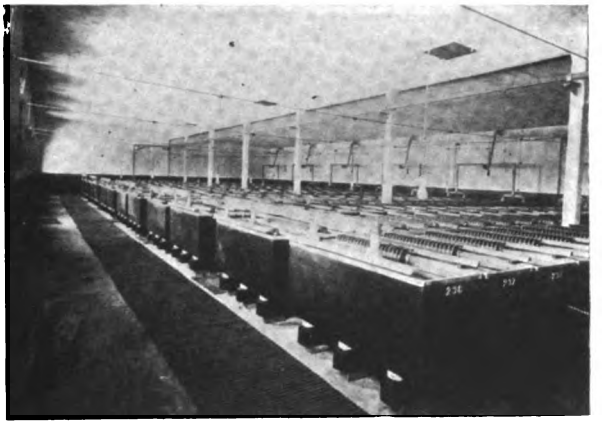
BY ORRIN E. DUNLAP.

THOSE who attended the convention of the American Street Railway Association, held in Niagara Falls in October, 1897, will recall the interesting discussion that followed the reading of Mr. Charles Hewitt's paper on "Application of the Storage Battery to Electric Traction," and will perhaps remember that Mr. H. H. Littell, general manager of the Buffalo Railway Company, stated that his company had been told that they could save $75,000 annually by the use of a battery. Since then the Buffalo Railway Company have installed a battery in connection with their power house and have started out to save all or a part of the promised amount.

The battery they have secured was made by the Electric Storage Battery Company, of Philadelphia, and it occupies a new fire-proof one-story brick building erected on the south side of the company's power house, on Niagara street. This building is most substantially constructed, and is in good keeping with the permanent improvements from time to time made by this progressive company, the officers of which are ever alert to do anything that will add to the efficiency of their service and station. The battery room is about 40 by 90 feet and has a concrete floor. A row of posts runs through the centre. There is a row of windows on one side, and at night incandescent lights furnish illumination. The capacity of the battery is 1,200 horse-power hours. It has 270 cells, connected in series. The tanks are 59⅞ inches by 21½ inches by 24¾ inches. The number of plates in each cell at present is 41, but provision

Digitized by Google

has been made so that a sufficient number of plates may be added to increase the capacity of the battery 66 2-3 per cent. without adding to or enlarging the tanks. This fact clearly demonstrates that the company have full confidence in the service of the battery. In size the plates used are 15 by 15½ inches.

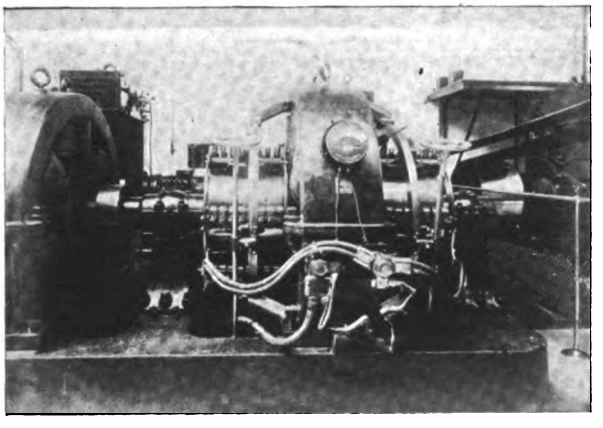


STORAGE BATTERY PLANT, BUFFALO STREET RAILWAY.

The positive plates weigh 24 pounds and the negative plates 16 pounds. The weight of the battery is 21,000 pounds.

In connection with their battery the Buffalo Railway Company have installed a booster, which they have given position near the center of the main floor of the power house. This booster was made by the Western Electric Company. It is direct connected to a six-pole Western Electric motor of 220 kilowatts. It is good for 3,000 amperes at 70 volts. Its purpose is the regulation, charging and distribution of the current of the battery. A feature of it is that it has two commutators in parallel, their diameter being 29 inches and their length 21 inches. The density of the current under the brushes under full load is under 20 amperes per square inch. The dimensions of the whole unit are 150 inches, by 79 inches, by 84 inches high, the total weight being 45,000 pounds.

Just inside the battery room walls the ends of the battery are connected by leaded copper bus-bars to cables which run to the switchboard. This switchboard stands on a gallery in the main room of the station. The panels are of black marble. It is equipped with differential ammeters to show whether the battery is charging or discharging. It also has differential voltmeters for the purpose of throwing the battery in parallel with the dynamos or rotary converters. There is a reversing switch connected with the shunt field of the booster for the purpose of changing the polarity of the booster to facilitate the charge and discharge. There are also two double pole switches, one of which is for the purpose of throwing the battery in parallel with the dynamos or converters, and the other for the purpose of throwing the battery through the booster or direct to earth, as circumstances call for.



BOOSTER, BUFFALO RAILWAY STORAGE BATTERY PLANT.

Ventilation of the battery room is secured through ventilators in the ceiling, which allow the gases to pass off into the outside air. A current of fresh air enters the battery room near the floor, and by this means the ventilation is made most perfect.

The Buffalo Railway Company now take 2,000 h. p. of the transmitted energy of Niagara. The peak of the load on the Buffalo system rises late in the afternoon, about 6 o'clock, and this the battery aids in meeting. From 7 a. m. to 7 p. m. the battery is operated in connection with the steam plant and with the converters during the night hours, until it is fully charged. During the early hours of the night the battery and converters take the load, and from about 9 p. m. to 1 a. m. the converters are charging the battery from Falls power.

The power house of the Buffalo Railway Company is a model of neatness in every particular. While the highest efficiency is demanded and obtained, economy is practiced at every point, and the claim is made that the actual cost of power per car mile is less in Buffalo than many other cities. The superintendent of the power house is Mr. Thomas Henning, who expresses great satisfaction with the battery installation and with the Niagara power service.

Notes From the Field—Electricity on the Pittsburg Street Railways.—I

BY C. B. FAIRCHILD.

"The world advances, and in time outgrows
The things that in our father's day were best."

THIS couplet is more than true, if it be applied to the street railway interests of Pittsburg, for in our own day and within a decade, things that were new have become old and have been replaced by better schemes, shaped out by men who have been made wiser by the rapid and steady growth of electrical truth. These men were so earnest they found no time to waste in patching; but have shoved aside the material and methods that were outgrown and that did not meet the demands of the time, and have reared a goodly work that is admirably suited to present requirements. The managers may well be envied by others who have not had the privilege of boldly shedding the old, and of putting on the new equipment. The scheme embraced the consolidation of all of the principal street railway lines of the city under the management of two companies, one known as The Consolidated, the other, The United Traction Co., with the mileage about equally divided and which embraces for each company territory in Pittsburg and Allegheny; the abandonment of cable power; and the re-equipment of all electric lines, and in the case of The Consolidated Company the power concentrated in a single station and central repair station. The same company has also six new modern power houses, and the manager has adopted a standard for cars, trucks, tracks and has grouped all the auxiliary appliances and details into units.

The Consolidated Company's new power station replaces the seven formerly required before the change from cable. The two storage battery stations, however, which were installed to help balance the power, will be retained. The location of the new station is on the bank of the Allegheny river, near Twentieth street, and not far from Penn avenue. The site is near the centre of the power distribution, making the average distance only about two miles, with a maximum of about seven miles. All the details of the power equipment, both electrical and mechanical, as well as the station, and in fact, all of the new structures, have been worked out by the chief engineer.

The power station is designed for an ultimate equipment of 20,000 h. p. The first equipment, however, consists of six direct coupled units. The engines are cross compound, condensing with cylinders 30 x 54 x 48, having Corliss valve gear, and there are several novel features in the construction of the crosshead, connecting rod, governing mechanism and other minor parts. The generators are each of 800 kilowatt capacity. There are twelve boilers of the water tube type, with a capacity of 4,500 h. p. The boiler room is parallel with the engine room, being separated by a fireproof wall, and the steam pipes drop down along the wall next the boilers and extend under the floor of the engine room to the cylinders, the throttle valves being controlled by hand wheels above the floor. An iron platform runs along the whole length of the wall of the boiler room on a level with the trunk steam pipe, from which the valves are readily operated. An electric traveling crane of 90,000 pounds capacity spans the engine room, providing for the quick handling of any piece of machinery. The building is of brick, the

Digitized by Google

front being of Pompeiian fire brick, and the roof is supported with steel truss girders, while the covering is of concrete, felt and gravel. Large ventilating areas are provided, and these are shielded with stationary slats after the manner of Venetian blinds. The ground dimensions of the entire structure are 272 by 115 feet. The engine room is 55 feet wide, and the boiler house 60 feet, including a coal storage bin, which runs the whole length of the structure. There is also an elevated steel coal bin extending the entire length of the boiler room, which has a capacity for six tons per running foot, or a total capacity of 1,632 tons. A coal conveyor is provided, which is operated by an electric motor, by means of which coal is received from boats or cars at the river end of the building, and is by it placed in either of the storage vaults, or is taken from one to the other, as may be necessary, and by which the ashes are also removed. The condensers and auxiliary steam equipment are located in the basement, or rather in partitions, designed for them between the engine foundations, which are built up of concrete. The foundations for the structure and equipment are not less interesting than the superstructure, being all of concrete and built as a unit, while it rests on a foundation of river gravel. It contains 20,000 cubic yards of concrete, the side walls being in some places seven feet thick. The sand and the stone for the foundation were obtained from the river nearby, and were delivered by an incline to a large home-made concrete mixer, which has the capacity of 600 cubic yards a day; all the foundation work was put in by the company. The condensing water is lifted from a well 45 feet in depth, which is sunk below the low water mark of the river, the pump being about 17 feet below the coping, and is provided with an intake tunnel extending to near the middle of the river, and protected by a filtering crib.

The switchboard occupies a brick lined room in the foundation, and the switches are operated by air pressure from the engine room floor. From this the current is led out by lead-covered cables, through a brick tunnel extending to Penn avenue, a distance of nearly 600 feet. The interior of the tunnel is 5 by 7 feet, providing for an ultimate capacity of 40,000,000 circular mils of feed wire, while there is room left for the free passage of the employés. The foundation to this tunnel is of concrete, and in this is embedded in two layers thirty-two 63 pound girder rails, having their ends double bonded, and to which the return feeders are attached. At Penn and Liberty avenues the cables are brought up to the arms of a distributing pole from which they are led off in eight directions.

The new repair shop and auxiliary buildings are known as the Frankstown avenue car station, and comprise four large buildings, all of brick with a steel truss roof and of about the same general design. The three main buildings are all of the same width, and are placed in line with each other in the direction of their longest dimension, and between them are ample storage tracks, while they are connected by two tracks running the whole length of the plot, one outside the line of the building, the other within and next to the wall on the opposite side. The first, or operating house, is 135 by 220 feet and is constructed with a brick floor. The repair shop proper is 135 by 576 feet, and is divided into paint shop, wood shop, erecting department and iron tool department, with pits and dismantling devices with an electric transfer table in each department. The storage house is 135 by 400 feet, and between it and the machine shop is a large area for storage containing twelve tracks, which are connected by a diagonal cross track, having both single and double slips. The warehouse is located just outside the storage tracks, and is 50 by 150 feet. The power for driving the tools is derived from an electric motor, while some of the machines are provided with an independent motor. A special feature are the dismantling pits which are located in the main shop, and are each equipped with four sets of screw jacks, mechanically operated from shafts driven by an independent motor. With this equipment, the car body being run on and the body supported by proper bearings, a portion of the track with the truck is lowered when the truck is run to one side and another one substituted. This is then lifted in place, and the wiring connections are made, the entire operation requiring only about fifteen minutes. The inspection pits are conveniently located, and have no partitions between them, the rails being supported on posts, giving free access from one to the other, and an iron grating is provided, which answers for a floor between the different pit tracks. There is a wheel grinding machine of novel design with which the wheels are ground without removing them from the car. A section of pit track is set apart for this purpose on which the car is run. The truck is then supported independently of the wheels, and a portion of the track under each wheel is removed. Centering lathe heads are provided on each side, and by removing the journal box covers the axles are readily centered and left free to rotate. The emery wheels are each operated by an independent motor, so that the speed can be regulated to suit the diameter, which varies as they are worn. These are so placed in the pit that they come in contact with the thread of the wheel on the under side, so the operation can be readily inspected, and being beneath the box, the dust cannot settle about the journal. The car wheels are revolved by their own motor in a direction opposite that of the emery wheel. To provide for proper resistance control under these conditions, a section of the trolley wire over the cars is partly cut out of the main circuit by means of resistance coils, which leave sufficient current to bring the car into position, while it provides for properly regulating the speed of the motor. An electric crane spans the main floor of the repair shop and provides for the prompt handling of car bodies, trucks or any heavy material.

The shops are provided with trolley hoists and all the labor saving devices which a long experience has proved to be desirable.

The buildings are warmed by a hot air system which includes a nest of steam pipes, with fan for forcing the air into the supply pipes. The storage house, which is also a receiving station, is provided with waiting and lunch rooms for use by the employés, and is equipped with 298 lockers, arranged in double-deck rows, each of which is ventilated and provided with hooks for clothing. In the receiver's office a marble slab is let into the counter at each window, which furnishes a smooth and durable surface, over which the envelopes and money are passed. The woodwork is of Georgia pine and finished and varnished in natural color. For ventilating the main floors, the deck lights on each side of the monitor roof are so arranged that for each section every other sash is attached to a sliding frame, which is provided with rollers and a track on which to run. By means of ropes that come down to the main floor, a whole section containing the alternate sash can be readily shifted, giving ventilation up to the full width of the sash.

The six new car houses are conveniently located in different parts of the city, and have the same general equipment. The one near Highland Park is built into the side of a bank, and one track is on the high ground, with a double track loop leading into the station, so that the trail cars can be dropped and run in by gravity. The front of the station is divided into waiting rooms, receiver's office, room for the trainmen, with lockers and tables and other suitable furniture. In the basement are toilet rooms for the employés, with wash basin and towels, the plumbing all being exposed, giving a very neat appearance. The finish of the office rooms is of yellow pine, and from the receiver's office a balcony opens out to the main floor, from which the foreman can count all the cars that may be in at any time. In the basement under the offices is located a supply room, boiler room and sand-drying apparatus. The building is heated by hot air, one of the old cable boilers furnishing the steam for heat, and for operating the fan of the heater. The telephone in the receiver's office is mounted on a hand elevator, so that it can be drawn and used by parties in the basement without the necessity of climbing the stair. The main building is of brick and corrugated iron, with a brick floor, the dimensions being 200 by 112 feet. There is track accommodation for thirty-four cars, while in front there are seventeen tracks, which occupy a large yard offering ample storage capacity. These tracks all connect with the main track, which forms the loop around the building. The house being designed only as a washing and inspection station, the cars when cleaned are run out and are held ready for service, an arrangement that saves the payment of insurance on the building. An electric transfer table operates through the middle of the floor, and on each side of the transfer track there is room for two cars to stand. The inspection pits occupy the space between the front and the transfer track, and these, like those in the machine shop, are not partitioned off from each other, but the tracks are supported on posts, while between the tracks an iron grating answers in place of the floor, which arrangement leaves but one floor to sweep, and prevents an accumulation of waste material.

As noted above, everything is standardized, and appliances

Digitized by Google

of the same kind are treated as a unit, repairs being made on a specified equipment at stated periods, without being left to wear out. The car trucks are of the McGuire type, the motors Westinghouse No. 38, and all the cars are provided with electric brakes of the G. E. type. The gongs are placed on the hood of the cars, and are rung by means of a cord that hangs just above the controller handle. This arrangement relieves the motorman from being obliged to stand most of the time on one foot, as when the gong is operated, as is usual by foot power, and also prevents the breaking of gongs, not one on the system having been broken for over two years. Moreover they do not sound as loud and offensive as when rung by foot.

Very few transfers are issued, as the routes are so arranged that they form concentric rings, coming to the same tangent point in near the centre of the city, and then spreading out balloon shape through the outlying territory. In answer to a question relating to the economy of the electric as compared to cable power on the lines which have been changed, the manager remarked, "that after the change the number of power plants was reduced from seven to four, sixteen boilers were sold, while a larger number of cars were operated," resulting evidently in a decided saving.

Trail cars are used on a number of lines, and all are equipped with the Van Dorn couplers for this purpose. These are so united as to leave no lost motion between the cars. On some of the trunk lines, the trail cars are dropped at the intersection of branch lines over which they are hauled by short independent motors. These dummy motors are entirely enclosed, and are provided with electric and wheel brakes, the latter being operated by a lever. By an arrangement of the trolley cord, the trolley pole can be manipulated by the motorman without leaving his cab. A continuous cord runs in both directions from the pole, passing down at each end of the car under a roller, and through from end to end under the ceiling. By this means the pole may be drawn down and freed from the wire by the motorman, reversed and returned to the wire ready for running in the opposite direction.

A new mail car of novel design, and which was built by the Laclede Car Co., of St. Louis, Mo., has recently been added to the equipment. This is provided with a stamp cancelling machine, which is operated by an electric motor. There are other labor saving arrangements which embody the latest practice adopted by the post office department.

The Consolidated Traction Company is operated under the management of C. L. Magee, president, and G. F. Greenwood, chief engineer and general manager.

Among the manufacturers and contractors for the new equipment mentioned above, the following may be noted: The Pennsylvania Iron Works Co., of Philadelphia,, engines and auxiliary equipment; The Babcock & Wilcox Co., boilers; Westinghouse Electric & Mfg. Co., generators; Pawling & Harnischfeger, Milwaukee, electric traveling crane; Alfred F. Moore, Philadelphia, lead-covered cables; Jones & Laughlin, structural steel for roofs and coal bin.

The Henry "Regenerative" Controller For Electric Cars.

BY JOHN C. HENRY.

DURING the past year the writer has been engaged in the development of a new method of control for electric cars, which is named "The Regenerative System," a brief description of which was published last summer.

The system consists mainly of a combination of the features of the series multiple control, electric brake and independently excited motors. After making hundreds of tests, the great majority of which were failures, we have succeeded in producing a street car controller which has the following surprising advantages over the best of those in common use:

First—For all practical purposes we are able to increase the capacity of the present standard forms of motors about 25 per cent.

Second—In ordinary electric railway service an increased efficiency of 40 per cent. is within reach over the present methods.

Third—Much quicker acceleration is available than is possible with the ordinary railway motors.

Fourth—An ideal braking system is provided without friction or wear of parts.

Fifth—Without regulation the cars may make the same speed in the suburbs, where the voltage is low, as they do in the vicinity of the power station, thus avoiding the necessity for boosters.

Sixth—Arranging so that the cars run (without regulation) on the up or down grades at about the same speed as they do on the level.

Seventh—Arranging so that the motors are electrically tied together, thus preventing one of them from racing when they are connected in series.

Eighth—Reducing the output of the station and consequently the losses on the feeders and rails.

Ninth—Protecting the motor from injurious induced currents.

Tenth—Arranging so that the torque of or the ability of the motors to start or pull a very heavy load may be temporarily greatly increased without an injurious current in the armature.

Eleventh—Providing a braking system which cannot flatten the wheels.

For traction purposes an independently excited motor has about 25 per cent. greater capacity than a series motor of the same size and cost. To explain, it is well known the capacity of any form of motor is limited only by its ability to withstand heat. It is also well known that the heating effect in the conductors is proportional to the density of the currents. It is also well known that in order to secure light weight, compactness, etc., the efficiency of railway motors is not high when they are working hard or when they are overloaded. The field magnets absorb about 25 per cent. of the energy. Theoretically they should absorb none. What is needed is a magnetic abutment. It is not essential whether it be in the form of temporary or permanent magnets, providing it is strong and compact enough.

Our claims to improved efficiency will be readily appreciated in considering the following points. Tests made on the principal street and elevated railways in the country show that about 60 per cent. of the total energy used by the cars is absorbed in getting them under headway. The most popular controllers now in use have eight running positions, six of which waste energy by passing the entire current through dead resistance. With our controller we use no resistance in the armature circuits. Our regulation is done by the smaller member, that is, the fields which ordinarily handle but about 10 per cent. of the current, and at no time over 25 per cent. of it.

The other principal saving comes in by recouping current to the line. It takes nearly as much power to stop a car as it does to start it. In stopping, our motors automatically become dynamos and generate a current to the line, thus relieving the station dynamos, feeders, etc. The stored up energy of the momentum in the cars, or the force of gravity on descending grades is turned back into the line in the form of current. This is illustrated in a pretty way by placing a wattmeter in the motor circuit. Turning the controller handle on makes the disc revolve in one direction, showing it to be driven by current from the line, while turning it off reverses the direction of the disc, showing the current to be going back into the line from the motors. So sensitive is the wattmeter and this method of regulating motors that the disc will frequently change directions while running on level track without changing the controller. This action being caused by slight fluctuations in the line voltage.

High speed of the car is automatically maintained in the suburbs where the voltage is low. The explanation to this is that the strength of the fields is controlled by the line voltage. When it is low the weaker fields allow the armatures to take more current, and consequently they tend to run faster but with less torque. In consequence of these oppositional influences, the speed of the car remains about the same as when it is near the power station.

The greatest advantage of the system is in the ideal way in which it brakes the car without friction, avoiding flat wheels, etc. By simply turning the controller handle backwards the car is readily stopped, smoother even than with the air brake, or it is retarded on descending grades and any desired speed maintained by regulating the controller handle. The braking is all done by the armatures, without any additional mechanism.

On many roads rapid acceleration is desired. This is within easy reach with our form of control, and may be obtained in a much more economical way than is possible with series motors. In series motors heavy currents are necessary to speed up the armatures quickly, while these same heavy currents must pass through the fields which strengthen its magnetization and in turn

Digitized by Google

tend to retard the armatures. In the "regenerative" system each member is supplied with currents independently, so that the requirements for torque or speed may be met directly without waste. In the series motor the field magnets are not self-protected, while in the regenerative system the fields protect themselves automatically; that is, their current supply is controlled solely by their resistance. If they heat their resistance is increased and the current reduced.

While the same theory applies in series motors, with them it has but a small fraction of the force, as in the former the voltage across the fields is the maximum from the line, while in the series motor, in excessive cases, it would not be over one-quarter of this.

The most frequent cause of injury to motors is the "back kick," which occurs when the circuit is broken. This is generally the cause of grounding motors. Principally for this reason, shunt wound motors have not been used for traction purposes. There are two ways to avoid this danger. The first, to wind the magnets with heavy wire, which is not practicable. The second, to provide a better path for this discharge than through the insulation. To avoid this flash, and to protect our fields from this intense piercing stress, we place a non-inductive resistance of small carrying capacity within the controller, and arrange it so that it is connected in parallel with the fields whenever the armature circuit is opened independent of the fields. This same resistance may be used in special cases to protect the motors from lightning by using a supplementary switch.

When running with the motor in series with the "regenerative" system, the adhesion is greatly improved. The motors may be connected together so that any tendency of one of them to race is instantly and automatically checked by its current supply being decreased and that of its mate increased.

The series multiple method of controlling motors looks very simple, but it was canvassed over a long time before its success was assured. To change a pair of motors, which are using a heavy current from 250 volt to 500 volt machines in a fraction of a second without injurious arcing of the current or mechanical strains on the machine and car is the requirement. It was met first by Mr. Potter in a unique way; that is, by short-circuiting one of the motors. In doing this, the motor starts to act as a dynamo, and generates just sufficient current to counteract the residual magnetism in the magnets, which if it were allowed to remain would be sufficient to cause a tremendous current to be generated in the armatures. In changing the armatures in the "regenerative" system from series to parallel this same method could not be employed.

Instead, we short circuit one of the armatures with resistance, leaving the fields excited. The resistance is predetermined and arranged so that the armature, although revolving under strong fields, has its tendency to generate in the short circuit. Counteracted by the line current, which attempts to drive it as a motor, these neutralizing forces permit the armature circuit to be broken without any flashing. Another method of changing the armature from series to parallel is to break the circuit when the fields are weak and connect them in parallel under the fields when their strength has been doubled.

In the regenerative system, the reversing is done by the fields instead of the armature. Provision may be made within the reverse switch whereby putting the reverse handle in a second notch connects the fields from series to parallel thus providing for great torque or breaking force. This is operative only while the motor man has the reverse handle in the second position and is intended for use in emergencies only, such as starting heavy loads, pushing disabled cars up short, heavy grades, or for emergency braking stops to prevent accidents.

Ordinarily fields are wound so they would stand the full line potential all day without injury to the insulation. They consequently are much more reliable than those of series motors. The armatures when doing the same work carry 25 per cent. less current than if they were working as series machines. They are not exposed to the high induced current ordinarily projected by the field magnets when the circuit is broken in series machines, which is the common cause of disabling armatures, and they consequently will be more reliable.

With the regenerative system the car must be accelerated by moving the controller handle slowly instead of depending on the gradual automatic reduction of the field strength as in series motors. It is also very important that the controller be turned off slowly, because when the handle is back in the starting position the car is at a stand. A quick sweep of the handle backward would make a stop too sudden for the passengers. It would send a tremendous current back into the line which would be liable to arc over at the motor's brushes and blow the fuse.

In the regenerative system arc extinguishing devices such as magnetic blowers, etc., are not necessary, owing to the small number of turns on the armature; the self induction and arc formed on breaking its circuit is very small as compared with that of series wound machines. In the regenerative system we break the armature circuit and maintain the fields at full strength, so that the back pressure is not reduced, and the difference of potential between the points of contact is but about 20 volts, as compared with 500 with the series motors.

When a reliable breaking system is arranged for within the controller, it leaves an opportunity for desirable improvements in car construction. The controller instead of occupying an unstable position at the car dash, where it is exposed to the storms, may be placed with its back against the end of the car body, under one of the windows between the steps and the car door. In this position, by using a specially arranged handle, the car may be operated from a position at the car door, either from the in, or outside, thus avoiding the necessity for vestibules, which are a necessity at some times, but generally a dangerous nuisance. This location is preferable, as the wires may be carried mainly under the car seats instead of exposing them underneath the car floor.

Newark, O. City Plant Mismanaged.

At Newark, O., on July 7, at the meeting of the City Council, a sensation was sprung by President D. L. Jones. He left the chair and called the attention of the body to the fact that the city electric light plant was being sadly mismanaged. The city, he said, was having the worst service in the history of the plant. Several men were employed therein, whose habits were so bad that for several days following each pay day they were incapacitated for good performance of their duties. Many lamps throughout the city gave no light because they were carelessly or improperly handled, and the time was not far distant when the city must incur a heavy expense to put the plant in good shape again. He offered a resolution, which prevailed, to have the light committee investigate the plant, with power to act. None of the employees were specified by name in the speeches of Mr. Jones and his colleagues. All would come under the investigation, though the head of the plant was recently made an elective office, and as such might be out of the reach of a Council committee.

PROF. SLABY has been appointed to a seat in the Upper House of Germany as a representative of the Charlottenburg Technical College, thus putting it on the same footing as the universities in Germany.

LIEUT. S. D. GREENE was on shore for a short time last week from the converted cruiser Yankee, and looked well after his busy West Indian cruise, though thin from constant work. In addition to incessant patroling, the Yankee was in five different fights, in all of which her Naval Reserve boys distinguished themselves highly. As they say, "they took in Spanish washing" every Monday morning for five successive weeks and have now sailed, hoping for a continuance of that singular run of luck. Lieut. Barnard, an old electrical man, is also on the Yankee.

MR. LUTHER STIERINGER, the consulting electrical engineer of the Omaha Exposition, has gone off with Mr. Uhlrich, its landscape architect, on a trip through the Yellowstone Park region, to see whether nature can suggest any new effects to them.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico, - - - - - -	per year,	$3.00
Four or more Copies in Clubs (each) - - - - - -	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies, - - - - - - - - - - - -	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1888.*]

Vol. XXVI. NEW YORK, JULY 21, 1898. No. 533.

Electric Power in Rolling Mills.

GRADUALLY but surely electricity is making headway in industries where other means of supplying power and light have heretofore reigned supreme. The iron industry in its various ramifications particularly has found in the electric current a powerful ally not only in the machine shop but in the rolling mill as well. What the current is accomplishing in that branch was very well brought out in a paper recently read before the Western Society of Engineers by Mr. Eugene B. Clark, of the Illinois Steel Company. As that gentleman showed, the conditions existing in a large rolling mill are particularly advantageous to the use of electric power for operating many of the auxiliary machines which are scattered through such a plant. Conceding that hydraulic and pneumatic transmission had each its own particular field in which it possessed special advantages, even when the field of each had been covered there still remained a large number of places to which power could be conveyed by electric means far more cheaply and conveniently than by any other method.

As to the question of "economy," Mr. Clark drew a distinction between the meaning of the word as viewed from the station manager's standpoint and that of the rolling mill superintendent. The item of convenience was oftentimes so important as to outweigh all other considerations. Mr. Clark then showed how motors of various types were applicable to the different classes of work in the rolling mill, such as the operation of cranes, hoists, conveyers, table rolls, transfer cars, charging and drawing machines, to all of which the series motor was peculiarly adapted. The shunt motor found its use in connection with lathes, shears, pumps, fans, grinding machines, crushers, etc. Then, again, there was the application of the current to lifting magnets, signals, testing devices, etc.

As to the lighting of rolling mills, Mr. Clark scored a good point for the enclosed arc lamp, which, he stated, possessed advantages even more marked than in the stores or halls, where they have superseded the open arc. It would appear that the trimming of an arc lamp in a rolling mill during a weekday nearly always interferes seriously with the operation of a part of the work being done there. Hence the long-burning enclosed lamp saves more money than is represented merely by the decreased cost of carbons, labor of trimming, etc. We dare say this experience will be noted in other industries as well, where continuous work is imperative.

As between the direct current motor and the alternating motor the author prefers the former for rolling mill work, for the present at least, on account of the difficulty of properly controlling alternating current motors in such work. Indeed, he asserted that the trouble at present was not with the direct current motor, but with the controlling apparatus. Here is a hint which ought not to be lost on motor manufacturers. The intermittent nature of the power demand evidently makes the rolling mill a particularly favorable situation for the installation of storage batteries. Indeed, Mr. Clark proved by an analysis of his load diagrams that the installation of a suitable battery would permit of one 1,600 h. p. generator taking care of twice their present load, while at present it would require the operation of two such units. Taken altogether, Mr. Clark's paper makes an excellent showing for electricity in this particular field, but it is a repetition of the experience in so many other directions. In the present case it is only recently that rolling mill owners have realized the advantages of electricity, and it is safe to say that a not unimportant one among the causes that have led to the low price at which wrought iron and steel are now produced in the United States is the adoption of electric power in rolling mills.

Street Railway Travel.

A RESOLUTION is now before the New York City Council compelling the street car companies to provide each passenger with a seat, and to hang up a sign on the car when it is full. The proposer, Mr. Christman, says he acts in response to repeated demands from the public for regulations compelling the companies to do this. The proposition is a pretty one, and we have no objection to it except its utter impossibility. It would be a dead letter from the moment it was adopted, simply and solely because the public would not allow it to be enforced. One of the great trials of Americans in Europe, take Paris for example, is the fact that they must not get into a bus on which hangs the "Complet" sign, and that they therefore often have to waste hours and hours of valuable time, because the law does not allow them to travel standing up. Speaking for ourselves and from what we know of the public, we do not hesitate to say that people are far less anxious to get a seat than to reach their destination quickly. The recent resort to electricity on the New York street car lines shows this. Formerly on many of the horse car lines, though cars were few, there was never much trouble in getting a seat. Now that the cars have been electrically speeded up, and multiplied several hundred per cent., they always seem crowded. People are going to take this car and not the next, or the one after that. They will not loiter on corners. They will not stand out in the heat or the wet. They want to "go right along." Besides, on many lines, the management could not run more cars than they now do in the rush hours. Neither space nor speed permit. Sometimes, motormen after being stalled, and having their cars full, try to push past the impatient throngs at the crossings, and the keen disappointment shown at their action tells the whole story. The American public would much rather be crowded for space than for time.

This speedy travel, however, to which the trolley, overhead and underground, is accustoming the public, requires all the safeguards available to be thrown around it, and this is why we have always advocated the use of better and stronger brakes than the ordinary hand type. In Washington recently another of those "accidents" happened due to the inadequacy of the brake when the car was on an incline and nearly all the sixty passengers were badly injured. For that there is no excuse; and in fact in Utah, where a deaf and dumb boy was killed by a car with defective brakes, the court has held the company liable even if the boy were "negligent." In short, mechanical brakes of some kind or another, are a necessary adjunct of modern electrical street travel, and their adoption must soon become general.

Railway Motor Control.

THE experience gained in the construction of dynamo-electric machinery has now reached such a point of perfection that little more can be hoped for except in the way of details. This is true as well of motors as of dynamos. Indeed, as was remarked by a recent writer, it is not the motor but the method of and the apparatus for regulation that require attention far more than the machine regulated. This applies, we think, with full force, to the railway motor. As a mechanical device, the car motor leaves little to be desired. It had its infant troubles aplenty, but one no longer hears of cars laid up by the dozen for repairs, at least not in any well regulated railway company. But one may well ask whether the method of regulation now generally in vogue is the ne plus ultra. The series parallel system is no doubt a great advance on its predecessor, but even it

Digitized by Google

will be conceded to have its disadvantages, due principally to the employment of the series motor. This has been recognized and, as a matter of fact, shunt motors are in operation abroad at the present time, though to a limited extent. A modification of this latter type is now advocated by Mr. John C. Henry who, on another page, describes his so-called "regenerative" system of car motor regulation. By a method of separate field excitation Mr. Henry claims to overcome a number of difficulties met with in the series car motor; and if all the advantages pointed out can be realized in practice there is a large field open to the system. We must confess that we would like to see the records of current consumption on a large road equipped with the Henry system, for there is still a wide margin of efficiency to be striven for in railway motor operation.

Light Without Heat.

AN item from the London "Lancet" is going the rounds to the effect that the incandescent lamp, really, you know, when you come to look into the matter, gives off heat as well as light, and no small amount of heat either. "We have found by experiment," it says, "that on immersing a 16-candle power lamp (100 volts pressure) in half a pint of water, the water boils within an hour and in proportionately less time when a 32 candle power lamp is substituted. If again the lamp be buried in cotton wool, the wool soon begins to scorch and ultimately to burst into flame. In one experiment which we tried the bursting into flame of the wool was accompanied by a loud report, due to the explosion of the lamp. It clearly appears from this that the incandescent electric lamp cannot be regarded as an unlikely means of starting a serious fire, and shopkeepers, especially those who exhibit highly inflammable fabrics, should know that there is risk in placing such goods too close to the lamp. The lamp in contact with celluloid fires it in less than five minutes, and therefore the danger is particularly obvious in the case of toy shops, where electric incandescent lamps are often suspended in the midst of toy celluloid balls."

It is a well known fact that incandescent lamps are almost invariably burned, for illuminating purposes, immersed in a half pint of water, the water being intended to cool its fevered brow. When water is not used, it is the common practice to tie them up in cotton wool, as the "Lancet" intimates; and occasionally to swing celluloid balls in tempting dalliance around them in blindman's buff style. But, seriously, it seems to us rather late in the day to find out that it is difficult to get light without heat, or that there is a definite amount of heat from the various forms and mediums of illumination. The "Lancet" will in due time discover that electricity on the same principle of resistance in the circuit is now used for heating and cooking; and if its able editor will kindly call at The Engineer office, his contemporaries there will be glad to give him a cup of 5 o'clock tea, boiled electrically. That, however, is no novelty in its way, and the "Lancet" could go back twenty years and find in print the facts it now parades as new with a warning to the ignorant. For ten years past, Tesla, Moore and many others have been trying hard to give us vacuum tube lighting, without resistance filaments, in order to get away from the only too-familiar facts of waste in heat in the incandescent lamp, which, after all, is and remains vastly superior in this respect and in various others to every competing method of illumination known commercially to mankind at this moment. Electricians will yet reach the approximate light without heat, but meantime under ordinary insurance regulations, the good old incandescent serves.

Building a Pacific Cable.

THIS country can never be a European power, but it is rapidly becoming a great Oriental power, and it is high time we built the Pacific cable about which there has been so much talk. Even if Spain should not wholly surrender her Pacific colonies now in making peace, she will have to let go sooner or later, and then we shall have to step in once again. The Sandwich Islands are ours by sheer weight and drift of events, and it is imperative for our future trade to keep "open doors" in the Far East, wherever possible, so that the hand of fate compels us also to insist on a prominent place in that part of the world, as owners if need be, but as rightfully there anyhow. We will go there peacefully if we can; but if we cannot, we will smash anything or anybody that gets in our way.

Such being the case, it is foolish any longer to be in touch with our dependencies and markets by the roundabout way of Europe; and that Pacific cable landing on our Californian shore and running thence to Hawaii, Japan, the Philippines, China and Australia must be built forthwith. That is a large contract, but this country is equal to the outlay and as we have not yet got the construction and laying plant, our English friends will gladly welcome the opportunity to do the job for us, while their Government will lend all the aid it can, if only for selfish motives, and the more readily because our coming promises the success of that larger generous plan of commercial intercourse under which there is no discrimination. We are glad to note therefore that the executive council of the Hawaiian Government has granted to the Pacific Cable Co. the right to land a cable there which will connect with the U. S. A., China and Japan. All told, the company proposes to lay 12,345 miles of cable, and the Honolulu section is to be laid within a year from the time that Congress grants the proper authority, which, we imagine, will now be easily obtained, with the addition of a reasonable subsidy to be offset by the free transmission of governmental messages. The Pacific Cable Co., with a capital of $10,000,000, and with such men as J. P. Morgan, J. K. Tod, J. A. Scrymser (of the Central and South American cables), Admiral Erwin and E. L. Baylis, ought to be quite competent to carry out its plans and purposes in good style, and should find an excellent return for its investment.

Independent Telephony in Indiana.

AN article has been contributed to the Fort Wayne "Gazette" by Mr. G. W. Beers, of that city, on the independent telephone movement in the State of Indiana. As is well known, that gentleman has been active in the campaign there, and he claims some decisive results for it. He says that instead of the 40 exchanges with 6,000 subscribers and practically no toll line service at the expiration of the main telephone patents, there are now 137 exchanges in the State with 20,000 subscribers and not less than 5,000 miles of intertown lines. This is but a beginning, however, for he adds that "this long distance movement is destined to occupy a position in the commercial life of the State excelled by no other interest." The truth thus set forth is incontestable, the growth of the toll lines being one of the most remarkable phenomena of present telephonic development, but beyond that lies the real long distance work of the Bell organization, which has already brought together the largest part of this country, and which so far remains without competition. In this respect, it is evident the Bell system retains enormous advantages over its competitors, making the proverbial "stern chase" a very interesting and protracted one.

LETTERS TO THE EDITOR

How Best to Secure Exact X-Ray Indications.

HAVING read with considerable interest the description of the Fessenden X-ray apparatus in your last issue, I cannot but feel surprised at the fact that in this and many other recent articles in various electrical journals reference is made to the fact that photographs or radiographs are still being taken in connection with X-ray work, while it is a well-known fact that by the use of the fluorometer a great saving in time and tubes is effected, and much more accurate work done.

To properly locate a bullet in almost any portion of the body by photography requires the making of two radiographs; the work on which, including taking, developing, fixing and printing, takes fully two hours' time, and the surgeon has even then to probe for the bullet to a large extent by guesswork, guided, of course, by the two radiographs before him. Now not only does this process take up some two hours of valuable time, but the long exposure deteriorates to a great extent the tube which is used, so that the expense is great compared with the work accomplished. In using the fluorometer the patient is laid upon the table, the instruments are adjusted, the tube is turned on for a total of not more than five to ten minutes, and the patient's body is marked at four different points, which represent the terminals of two lines crossing each other at right angles at the intersection of which the bullet is absolutely sure to be found. In this case, as you will note, the marking is direct upon the

Digitized by Google

body and no error can possibly be made by the surgeon.

In view of these facts, it is almost impossible for me to conceive that any one could resort to the taking of a radiograph in the present advanced state of the art.

New York, July 13, 1898. W. J. CLARKE.

TELEPHONY AND TELEGRAPHY

"Citizen" and "Bell."

The Grand Rapids (Mich.) Press relates this incident about a man and a woman who are employed in different offices in one of the large buildings of that city. Each office has a telephone, but as it happens one is an instrument belonging to the Citizens' company, the other a Bell instrument. One day the man had occasion to use the Citizens' line and stepped across the hall to the lady's office. "Have you a Citizens' 'phone?" he asked, and she replied in the affirmative. "Well," he ventured, "I'm a citizen. May I use it?" Why, of course he might use it. An hour later she balanced the accounts with him. "Have you a Bell telephone?" she asked, on stepping into his office. He did not try to deny it. "Well, I'm a belle. May I use it?"

Recent Marconi Wireless Telegraphy in England.

JUST before last Christmas, the Wireless Telegraph & Signal Co. made a number of interesting tests with Marconi apparatus in the vicinity of the Isle of Wight, England, sending signals a distance of 18 miles. Since then they have established a station at Bournemouth, between 14 and 15 miles from Alum Bay, Isle of Wight, and between the two stations they keep up constant communication, with results already noted by the press. Lord Kelvin paid a visit recently to the experimental plant, when he examined the instruments carefully, and witnessed the sending and receiving of various messages. He sent dispatches wirelessly to Dr. MacLean, his chief assistant in the Physical Laboratory of the University of Glasgow; to Sir George Stokes at Cambridge; to Lord Rayleigh and Mr. W. H. Preece in London. The message to Sir George Stokes was as follows: "Stokes, Lansfield Cottage, Cambridge. This is sent commercially paid at Alum Bay for transmission through ether, one shilling, to Bournemouth, and thence by postal telegraph, fifteen pence, to Cambridge. Kelvin." Wishing to show his appreciation of the system and to illustrate its availability already for commercial use, Lord Kelvin insisted on paying a shilling per message royalty for the use of the Marconi system on all the messages he sent.

The system was also demonstrated recently before the British House of Commons, and the opportunity to inspect and investigate it has been freely afforded to scientists and others.

Telephony in Russia.

A report issued by the Russian postal and telegraph administration for the year 1897 contains some interesting information with regard to the present position of telephony in that country. The telephones are partly worked by the Bell Company and partly by the State, but it would appear that the former has managed to ocupy the most remunerative areas, for while the number of subscribers to the two systems is nearly the same (11,171 and 10,419 respectively), the company works 11 districts in which are 15 exchanges, and the Government business is divided over 67 districts with 80 exchanges. The State owns 2,875 miles of lines, corresponding to 15,130 miles of conductor, and has 11,616 telephones in use. The length of the company's lines is 848 miles, and the length of conductor is 15,580 miles. The proportion of these figures is explained by the fact that the company's areas include the large towns of St. Petersburg, Moscow, Warsaw, Odessa, Riga and Lodz. Concessions for all but the last mentioned of these towns were granted in 1882, for Lodz in 1884. No new concessions have been granted by the Government since the year 1886, and on November 1, 1901, the State acquires the whole system.

When an electric tramway is started in a town the telephone wires are altered to prevent disturbance in them, and the cost of this is charged to the tramway company. There are public pay stations in several towns, the charge for a three minutes' conversation being 11 cents for conversations with local subscribers, 23 cents through trunk lines up to a distance of about 33 miles, and 39 cents up to a distance of about 65 miles. The trunk lines between Odessa-Nikolaieff, Rostoff-Taganrog and St. Petersburg-Terrioki have produced a revenue of $21,500. The work of erecting the trunk line from St. Petersburg to Moscow was resumed in the spring. The charge for a three minutes' conversation will be $1.18, and a person will be allowed the immediate use of the line, out of his proper turn, for a triple fee.

Telephony Between St. Petersburg and Moscow.

The long-talked-of telephonic communication between the two Russian capitals, Moscow and St. Petersburg, is likely this year to become an accomplished fact. The line is under the control of the Imperial Telegraph Department, and the stations will be at the chief telegraph office in either city. As the average speed of ordinary telegraphic dispatches between Moscow and St. Petersburg, which are four hundred miles apart, is about that of the railway, ten or twelve hours being considered good time, the new telephone will prove an inestimable boon to business men, who in case of urgency are now obliged to pay three times the ordinary tariff to get their dispatches through as "special" messages. The line is not likely to be actually in working order before October.

Government Cable to Block Island, R. I.

A new Government cable has been laid between Block Island and Narragansett Pier. The cable was laid by order of Secretary of War Alger, and at Narragansett connects with the Providence Telephone Company's line, thus giving direct long-distance communication from Block Island to New York and Washington. While it will be open for public service primarily, it will be used for the Government signal service, and for the first time will establish direct connection with the signal service stations along that coast.

The Arc as a Telephone.

MR. H. T. SIMON, in writing to the "Wiedemann Annalen," No. 2, 1898, made the following interesting observations: If the circuit of an arc lamp happens to be close to another circuit traversed by feeble intermittent currents, the arc emits a loud rattling noise. The intermittent currents may be produced by a tuning fork interrupter, or by the hammer of a small induction coil. They produce in the arc circuit intermittent induced currents, and the latter affect the temperature of the arc and produce the noise. That the noise is due to the arc itself, and not to the regulating mechanism, is proved by the fact that the sound is heard equally clearly when the carbons are a fixed distance apart. Mr. Simon attempted to obtain a photographic record of the flickering of the arc, but failed because the changes of brightness are too slight in comparison with the total brightness. On placing a microphone in the primary circuit, the note of a tuning fork, and the sounds of whistling, tapping and singing were reproduced by the arc with every detail of intensity, pitch and quality. Experiments made with a shunt circuit showed that the quantity of electricity capable of producing an audible sound was 5×10^{-6} coulombs, corresponding to a change of temperature of 0.3° C. Sound waves acting upon the arc direct produced changes of density and fluctuations of the current, which could be transmitted to a distance and reproduced by a telephone at the other end.

Sender Must Stamp Telegrams.

Mr. N. B. Scott, Commissioner of Internal Revenue, has written a letter to the Western Union Telegraph Company, in which he says: "Upon the question as to whose duty it is to affix a stamp required by the act of June 13, 1898, to each telegraphic message offered for transmission, you are advised that this office rules that this duty devolves upon the person who makes, signs or issues the message."

Digitized by Google

Another Big African Telegraph Scheme.

KING LEOPOLD, of Belgium, has given Mr. Mohun, who was formerly United States Consul and Commercial Agent in the Congo Free State, and has since occupied a similar position in Zanzibar, a commission to build a ling of telegraphs from a point about the middle of the west coast of Lake Tanganyika to Nyangwe on the Upper Congo, a town which was formerly famous as the headquarters of the Arab slave traders who had established themselves in the Upper Congo region. From Nyangwe Mr. Mohun is to carry a line along the river as far as Stanley Falls, where it will join the line connecting Stanley Falls with Boma and the lower river. From Stanley Falls the line is further to be carried along the Aruwimi, the river of which so much was heard during the Stanley Emin relief expedition, to Wadelai, in the valley of the Upper Nile. It will be seen that in this way two long arms will extend from Stanley Falls and join the great trunk line from south to north which Mr. Rhodes is pushing forward across Africa with so much energy. Mr. Mohun is allowed an entirely free hand in the selection of his staff, and English and American engineers will be employed. From Tanganyika to Nyangwe the forest trees are to be utilized, but along the banks of the Congo and the Aruwimi poles will be erected for carrying the wire.

MISCELLANEOUS

Alternating Current Transformers—From the Station Manager's Viewpoint.[1]—II.

BY W. F. WHITE.

(Concluded.)

IN another case one section of the city, comprising ten city blocks, was fed by one dynamo and a circuit through 71 transformers having an aggregate rated capacity of 4,482 lights, and aggregate core losses of 10,402 watts (estimated), or 91,121,520 watthours per year.

To replace these transformers, a three-wire secondary network was erected, supplying all customers, and fed by five 400-light transformers located at as many feeding points or local centres of distribution. Each transformer was provided with primary and secondary switches, by means of which each night all transformers were thrown into service from dusk until midnight, at which latter hour four transformers were cut absolutely out of circuit. On a yearly average, five transformers were in circuit about six hours per day, and one transformer the remaining eighteen hours per day. The combined core losses of the five were about 1,250 watts, and for the hours in service aggregated about 4,380,000 watt hours per year. Some results of the above changes on this one circuit, therefore, were as follows:

No. of Transformers.	Lights Capacity.	Total Core Losses—Watts.	Total Annual Core Losses, Watts.	Equivalent Tons Coal
71	4,482	10,402	91,121,520	446.7
5	2,000	1,250	4,380,000	21.5
Saving	2,482	9,152	86,741,520	425.2

A reduction of over 95 per cent. in core losses, and a saving for one year in cost of fuel alone of $815.40 were effected for this one circuit. These examples were extremes, because the lighting covered by them was concentrated, and because in most residences and outlying business districts few changes in the number and capacity of transformers could be made. The results shown by the last example were therefore much above the average for the whole plant, but serve to show the possibilities of such changes and the methods pursued in this case.

Some results for the plant as a whole may therefore be fairly indicative of what other average plants operating under similar conditions may accomplish in the same direction, and were as follows:

Time.	Lamps Connected.	Transformers Connected.	Total Capacity.	Average Lights Capacity.	Av. Lights Served.
Jan. 1, 1895	16,702	547	22,190	40.6	30.6
Jan. 1, 1896	19,282	201	13,865	69.0	90.1
Jan. 1, 1897	20,262	152	13,498	88.8	133.3
Jan. 1, 1898	23,643	141	14,946	106.0	167.7

Time.	Income.	Switchboard Output, K. W. Hours.	Income per K. W. Hour Output.	Increase of Income per K. W. Hour Output.
1894	$59,012.71	928,400	.0635	..
1895	54,231.67	791,752	.0684	7.7
1896	51,415.29	551,064	.0933	46.9
1897	56,317.42	508,070	.1108	74.5

Year.	Actual K. W. Hours' Output.	Estimated K.W. H'rs Output Basis, 1894 Conditions.	Estimated K.W. H'rs Saved by Change.	Estimated Saving in Coal, 1894 Basis. Tons.	Cost.
1894	928,400	.....	.....	....	.....
1895	791,752	854,042	63,290	310.2	$670.91
1896	551,084	309,689	258,625	1,267.8	2,641.42
1897	508,070	886,888	378,818	1,856.9	4,015.43

It must be borne in mind that the number of 16 c. p. equivalents connected Jan. 1, 1895, was 16,702, and increased by Jan. 1, 1898, to 23,643, or more than 41.5 per cent. The savings estimated in the last table are based on the conditions at the beginning of this period, that is, the same number of transformers and the same transformer capacity. But if the same conditions had obtained throughout, an increase of 41.5 per cent., or 227 transformers, of 9,208 lights' capacity, would have been added to supply the new lights connected. And while only a part of the core losses of the transformers in service Jan. 1, 1895, was saved by the change, the entire losses of the 227 transformers, which would have been required by increased business, were saved. It is, therefore, perfectly safe to add 50 per cent. to the savings shown in the last table, in estimating actual benefits. From reduced core losses alone, therefore, an annual saving of approximately $6,000.00 is being enjoyed.

In core losses alone, the savings already effected have more than paid all costs of the entire change of lamps, meters and transformers (for because of a simultaneous change from 52 volts to 106 volts, secondary, all lamps and meters also had to be changed), and of the erection of secondary networks, and the annual saving of $6,000.00 is equal to 6 per cent. interest on $100,000 secured without one dollar invested.

To be certain that the saving of fuel was in proportion to the reduction in kilowatt hours output, as estimated, the plant efficiency under the changed conditions must be known. It is, therefore, pleasing to note that, using coal from the same mine most of the time, the watt hours output per pound of coal actually increased for 1896 by 3.3 per cent and for 1897 by 5.9 per cent over 1895, so that the saving in fuel was at least not less than in proportion to the saving in kilowatt hours output.

Some incidental advantages of the change may be mentioned.

First—Under the old plan, the 6,941 lights added would have required about 9,200 lights additional transformer capacity, of 40 lights average size, of $1 per light, average cost, giving an investment saving of $9,200.

Second—The transformer load, with open secondaries, of 80 amperes, was reduced by the Fall of 1897, to about 30 amperes, notwithstanding an increase of about 25 per cent. in the number of lights connected. A saving of 50 amperes at 1,000 volts represents a capacity to serve, without additional station or line

[1]Paper read at the general meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

equipment, approximately 1,000—16 c. p. equivalents, all burning at one time, or fully 2,000—16 c. p. equivalents connected.

Third—Formerly as many as a dozen transformers were frequently burned out in a single "thunder" storm. Ten per cent. of the transformers connected would be a conservative estimate of the number burned out each year from various causes. Of the new transformers connected during the past three years only one has failed from any cause, that one was defective, and burned out under light load almost immediately upon being put in service. Transformer repair costs are therefore practically eliminated.

Fourth—Incandescent lamp renewals have been greatly reduced. Using lamps from the same factory, of the same efficiency, and bought at the same price per lamp, the cost (estimated) of renewals per k. w. hour consumed by the lamps has been reduced from $.0081 in 1895 to $.0057 in 1897, a reduction of 29.6 per cent. This saving represents the advantage of regulating the secondary voltage by pressure wires connected to the secondary network, as compared with the former method of regulating the primary voltage by station transformers.

Fifth—The principal remaining incidental advantage is the uniformity of voltage, bringing uniformity in quality of service and consequent satisfaction of customers, the value of which cannot be estimated in dollars or percentages. These are some actual results and such as any plant operating under similar conditions can achieve at small expense, if the changes are well planned, and the replaced apparatus sold to the best advantage.

In this connection, attention must be called to one other fact, which is that central stations using separate transformers for individual customers have the great majority of their transformers working on open secondaries probably 80 per cent. of the time. The best transformers have a power factor of about 50 with open secondaries, and of fully 99.9 with almost any load they carry in practice. It is therefore perfectly credible, and the writer has demonstrated it to be so by many actual tests on various plants that the average power factor of plants operating under above specified conditions is approximately 65.

It scarcely needs demonstration that if, instead, a secondary network is used, and only such transformers allowed to remain in circuit at periods of light load as are required to advantageously carry such load, the average power factor will be approximately 100. The volt-ampere hours therefore, calculated from the station voltmeter and ammeter readings, give approximately the watthours output. But almost all existing plants use separate transformers for individual customers, and the great majority of them do not have primary wattmeters on their switchboards, and do calculate their volt-amperes-hours output as equivalent to watt hours, getting results about 50 degrees in excess of the facts. They therefore are able, apparently, to show 50 per cent. more watt hours per pound of coal, and 33⅓ per cent. less expense per k. w. hour output than another station operating under the same conditions and fully equaling theirs in actual performance, but which accepts the primary motor readings as the basis of estimate.

As a matter of fact, the usual disparagement is greater than the percentages given, because most station managers in erecting primary switchboard meters, follow their æsthetic inclinations, and use ornamental glass covers which are particularly susceptible to the admission of dust and grit, with the result that the meters rapidly slow down. It is highly probable therefor, that in some section the volt-ampere-hour record would show twice the number of apparent watthours per pound of coal and one-half expense per apparent k. w. hour output that would be shown by the record of the primary meter already erected on the switchboard, which tends only to show the worthlessness of the data from different plants, for purposes of comparison, unless the local conditions are known in each case.

This digression is permissible, we hope, because the average power factor, so far as we know, has never been taken into account, and because for that reason much misleading alternating central station data is in circulation.

Purchasers and users of transformers should insist that transformers meet certain requirements, or be rejected, and some of these requirements will be stated.

Where transformers are used for feeding networks, the secondaries in multiple, small core losses are of much greater importance than close regulation, and should be kept at the lowest practicable point. The regulation will be cared for by treating the transformer and feeder drop together, through the use of secondary pressure wires.

Where the transformers are entirely independent, feeding separate secondaries, close regulation must be had and the core losses be made as low as the adopted regulations will permit. With constant full load the temperature must not rise to a high point, and should not exceed 50 degrees centigrade above the surrounding air. This is important not only because of the increased life of transformer insulation through low temperatures, but also, and possibly to a greater degree, because magnetic fatigue is a certain follower of high core temperatures. If, therefore, the core losses might be increased 50 per cent., or, possibly 100 per cent., through high temperatures, the cost of these core losses, as shown in the case of the plant above, makes argument unnecessary as to the desirability of having transformers run cool.

The transformer case should be filled with oil, because of its insulating qualities and its exclusion of air, and because of its assistance in maintaining the low temperature desired.

The insulation resistance between the primary and secondary windings should be able to stand up under not less than 10,000 volts, alternating, difference of potential, for transformers having 1,000-volt or 2,000-volt primaries, and the writer would strongly urge a 15,000 volts alternating test. If both the primary and secondary windings are on the core, the same insulation resistance should be required between either winding and the core, as between the two windings. The use of grounded shields placed between the primary and the secondary windings, the grounding of the shield or core, the grounding of the secondaries, the placing in each customer's service connections of any device to automatically open the circuit of such customer in case of an unusual difference of potential, are all practices that are opposed as expensive, as liable to cause, more than to prevent, trouble, as complicating existing practice, and as wholly unnecessary.

Proper insulation is sufficient protection against the damages sought to be avoided. Station managers as earnestly desire complete safety for life and property as the Underwriters' Association, but vigorously oppose the introduction of any unnecessary devices that are expensive to install and to maintain. That association, in seeking protection for the secondaries, should do so through sufficient transformer insulation and low temperatures. Both of these requirements mean increased cost of production and higher selling prices, but as the consequent increased economy makes the increased cost a profitable investment no reasonable manager will object. In this way the ends sought will be best attained, and the interests of all parties duly safeguarded.

Dielectric Strength of Air.[1]

BY CHAS. P. STEINMETZ.

TO investigate the dielectric strength of air, tests were made of the striking distances in air between parallel cylinders of different diameters, between sharp points, and between spheres of different sizes. Further tests were made on the effect of inserting a conductor in or near the path of the disruptive discharge and investigating its influence on the striking distance.

As a source of power, an A-8 smooth core alternator of the Thomson-Houston type was used, of about 30 k. w. capacity and a frequency of 125 cycles, giving practically a sine wave. In other tests a 60 k. w. high-frequency ironclad alternator of the Thomson-Houston type was used, giving the well-known sawtooth form of wave. The alternator was driven by a direct current motor of ample capacity.

With alternating e. m. f.'s of only 125 cycles, the luminous phenomena, as brush discharges from conductors, etc., were much less marked and brilliant than observed even at lower voltages, with oscillating currents of very high frequency, as given by a Thomson transformer.

For the purpose of these tests four high-potential transformers were built, of the ratio of transformation 1 : 18 and of a rating of about 7.5 k. w. each. They are of the standard air-blast type, but were used when immersed in large wooden tanks filled with oil.

Each of these transformers contains two primary and two secondary coils, the two high-potential secondary coils in the center, the low-potential primary coils at the outside.

[1]Abstract of a paper read at the 15th Annual Meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

Before undertaking the final tests, a number of preliminary tests were made to determine,

1. The constants of the generator and the transformers and the total power thus available in the discharge circuit.

2. The equality of the ratio of transformation of all four sets of transformers, since only at two out of the four transformers was the voltage measured.

3. The constancy of the ratio of transformation, since it was relied upon for determining the high potential voltage.

4. The shape of the generator wave and its variation under the conditions of tests.

The results of these preliminary observations are as follows:

Voltmeter readings on the low-potential side of the high-potential transformers give a striking voltage correct within one per cent., irrespective of the capacity of the discharge circuit, within the limits of the tests.

The wave of the smooth core alternator is practically a sine wave, and is not changed by transformation or by capacity of the discharge circuit.

Since the accuracy of the striking distance determination can not well exceed one to two per cent., these preliminary tests show the method as correct within the errors of observation.

The author then describes a number of tests to determine the striking distance between parallel cylinders, giving the results in the form of tables and curves and observing that the striking distance increases faster than the voltage. A number of tests with spheres are also recorded with these results:

While the striking distances between spheres of different diameters are very different at intermediary voltages, they seem to coincide at very low and very high voltages, but differ essentially from the curve taken between sharp points, except at extremely high voltages.

From all these tests it should be expected that a law on the disruptive strength of air could be derived.

The disruptive electrical discharge bears a striking analogy to mechanical rupture. Thus, as the mechanical strength of a beam remains practically unimpaired up to a certain load, and at this load suddenly falls to zero by mechanical rupture, so the resistance of an air space is practically infinite up to a certain potential, at which, under disruptive discharge, it suddenly falls down to practically nothing. In looking for a physical law representing the electric disruptive discharge, it thus was to be investigated how far the laws of mechanical strength would represent the observed effects.

Under mechanical stress, rupture takes place as soon as the stress exceeds the breaking strain anywhere in the material, and this breaking strain is a constant of the material. Thus I investigated whether the disruptive discharge of air takes place as soon as the dielectric stress, that is the electrostatic gradient anywhere in the path of the discharge exceeds a certain constant value, which would be called the "dielectric strength of air" in analogy to the "mechanical strength" of a material. The mechanical strength of a material is tested by subjecting it to a uniform mechanical stress, the usual test of tensile strength by pulling a test piece of known cross-section to pieces. The analogous test of the dielectric strength of air would require a uniform electrostatic field, that is, parallel plates of perfect polish as electrodes. This is obviously not feasible. Thus I chose a shape of electrodes giving a relatively simple, although not uniform electrostatic field.

Between spheres, the lines of electrostatic force and equipotential surfaces are curves and surfaces of higher order. Between parallel cylinders, however, lines of force and equipotential lines are two linear systems of pencils of circles, or rather cylinders, that is, all lines of electrostatic force are circles intersecting each other in two points, the fundamental points of the pencil, and all equipotential lines are circles intersecting the first set at right angles, and containing the cross section of the cylinders as one pair.

Some further results on the question of the constant dielectric strength of air can be derived from the tests with points and with spheres as terminals.

Between mathematical points the dielectric field of force is similar regardless of the distance. Thus with the needle points used, for all distances great compared with the radius of curvature of the needle points, that is already the smallest distance investigated, the striking distance should be proportional to the voltage if it depends upon the maximum gradient. This, however, is not the case.

Between mathematical points even with the lowest voltage the gradient at the points is infinite. Thus with needle points very small voltages should strike over great distances. This is not the case either, but the curve of needle points does not differ much from that of ¼" spheres. This leads us to one of the phenomena obscuring the true electrostatic gradient at the moment of disruption, the brush discharge.

Long before the disruptive voltage is reached between needle points and smaller spheres or cylinders, a brush discharge issues from the terminals into the surrounding air. The space surrounding the electrodes is filled with an infinite number of violet streamers issuing from the electrodes under a hissing noise and being constantly in motion, and this space is thus more or less broken down dielectrically, so that, when the final disruptive discharge takes place, the terminals of the discharge are no longer the original metal terminals, but the whole space covered by the brush discharge is more or less to be considered as discharge terminals.

To investigate whether the dielectric strength of air was reduced in fog, as occasionally suggested at that time, a steam pipe was arranged below the discharge circuit and steam made to escape very slowly, so as to fill the whole space between the needle points with dense fog. Against expectation it was found that a much higher voltage was required to strike across the same distance in fog as in dry air. From this it will be seen that fog increases in dielectric strength of air and reduces the striking distance very markedly. This may be explained by the assumption that the discharge is by the fog broken up in an infinite number of minute successive discharges, between the conducting fog particles, requiring a higher total voltage than the direct discharge over the same total distance.

By turning full steam on, issuing from the boiler at 80 pounds pressure into the space between the needle points, the striking distance was still reduced further below that in fog, that is, live steam at atmospheric pressure has a much greater dielectric strength than dry air.

From these tests, the following results are derived:

1. At constant voltage and constant wave shape, that is constant ratio between maximum and effective e. m. f., the striking distance is a constant, especially between sharp points, where the tests have been repeated over and over again, and independent of the atmospheric condition, the frequency, etc., to such an extent that the striking distance between needle points offers the most reliable means to determine very high voltages. For this reason, it is used in this manner as final check in all high potential insulation tests of the General Electric Company.

2. No physical law has been found to represent satisfactorily all the observations. Some point to the existence of a constant dielectric strength of air, analogous to the tensile strength of mechanics. Others point to the existence of a spurious counter e. m. f. of the spark or transition resistance from electrode to air.

3. Constant dielectric strength. Cylinders of 1.11" diameter give an average disruptive strength of air of 60 kilovolts per inch. Cylinders of .315" diameter, an average dielectric strength of 77. Spheres at very small distance point toward the latter value. As a disturbing factor in this case, enters the electrostatic brush discharge, which by a partial breakdown of the air surrounding the electrodes changes and increases the size and decreases the distance of the effective terminals.

4. Counter e. m. f. of the sparks. The tests with sharp points give 22 kilovolts, or 11 kilovolts for a single transition from terminal to air. Spheres give curves pointing to a similar phenomenon. Electric conductors inserted at right angles into or parallel with the discharge, point to the existence of a counter e. m. f. of the same magnitude. The beginning of the electrostatic brush discharge is at a potential of this magnitude also.

5. Potentials of 160,000 volts effective and even up to 170,000 volts have been experimented with. They are probably the highest voltages ever reached by man at ordinary frequencies with alternating currents of considerable power.

SAN FRANCISCO, CAL. The Pacific Coast Electrical Transmission Association held its annual meeting at the Cliff House on June 21, when an enjoyable and instructive time was had. The election resulted as follows: President, W. Frank Pierce, of the Blue Lakes Water Company; vice-president, Carrol M. Beal, of the Power Development Company; secretary, George P. Low, editor of the Journal of Electricity; treasurer, William Angus, of the Stanford Electric Company.

Digitized by Google

Lightning Arresters.[1]

BY A. J. WURTS.

IT is important in discussing a subject of this kind, which has been treated both in practice and in the laboratory, to establish the value of the laboratory experiments. The question is in experimenting with a static machine, are the experiments and deductions that we obtain there, fair in connection with lightning arresters which we use in our electric light plants? It seems to me that they are. The phenomena that we observe in the laboratory correspond with those which we obtain from a static discharge from our wires. In Fig. 1 I have drawn two straight lines, which may represent two perfectly straight wires, if you choose. In practice, during a thunder storm, that discharge does not occur from any one particular point. It will occur from this point or that point, according to certain conditions. Now, in the laboratory tests I have sent discharges into the upper wire there, called the A wire, and these discharges have to pass from the A wire to the B wire. The question is, where will that discharge occur. I have found that it may occur almost anywhere along the wire. Why is this? It seems to be because the static charge which is in the wire during a thunder storm surges back and forth on this wire in such a way that these waves collide with each other. To illustrate, take a trough of water and lift one end of it. Lower it and this water will surge back and forth in this trough. Now raise the end of that trough again and you get another set of waves. What will happen? Under certain circumstances the waves will collide, pile up and cause a splashing; under other circumstances, owing to

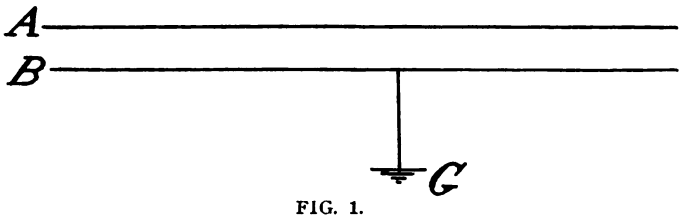
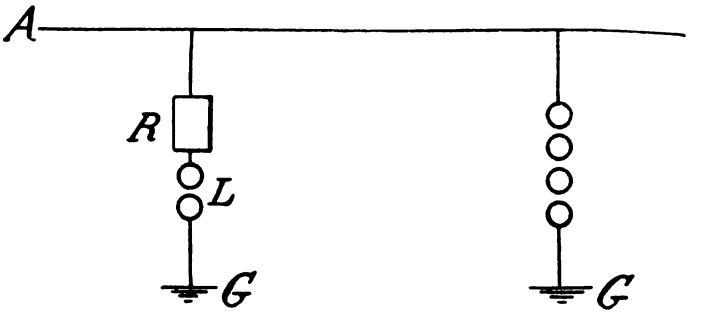


FIG. 1.

a balancing of the waves, a smooth place will be formed. That is what occurs in these wires. We have a splashing, and this static discharge tends to jump from the wire at these points where the splashing occurs. Now, it seems to me that these wires are charged by conduction from the atmosphere. Why? Because the wires become charged not only during thunder storms, but also during perfectly clear weather. The wire becomes a part of the electrically charged atmosphere, and, as I have explained, sparks tend to jump from the wire to the ground through any path that they can find.

Now, the point that I want to bring up, especially to the central station men here, is this: What is the easiest path for these discharges, and how shall we judge one kind of lightning arrester from another? In Fig. 2 I have shown a spark gap L and a resistance in series with that spark gap. In Fig. 3 I have shown three spark gaps without any resistance in series with them. The lightning arrester shown in Fig. 2 is a lightning arrester which is on the market now, and it is said of it that the insertion of this resistance decreases the necessity of spark gap; that is to say, by inserting a resistance we may use a smaller number of spark gaps than we could get along with without the resistance. Now, the question is which one of those paths will offer the least resistance to disruptive discharges. In determining the resistance of lightning arresters I have placed in shunt to any given lightning arrester, a variable spark gap, as shown in Fig. 4. Here a spark gap is shown with resistance in series, and in shunt to that arrangement I have placed a variable spark gap. Now, in the laboratory I have sent a disruptive discharge through that system from A to B. What path will that spark take—the lightning arrester or that variable spark gap in shunt to it? It will depend upon the length of the shunt spark gap, which I have called B[1]. If that B[1] spark gap is closed, the discharge will evidently take that path, and will avoid the lightning arrester, and by increasing the length of that shunt gap until the discharge will pass either through the arrester or through the shunt gap—by increasing the shunt gap until the spark will pass either one way or the other, we finally arrive at a point by which we can measure the resistance which the lightning arrester offers to the passage of disruptive discharges. The length of the spark gap which we obtain is the measure of the resistance of that lightning arrester. I have seen several statements in the papers to the effect that the lightning arrester should have a low breaking down e. m. f.; that is, you apply an e. m. f. to the terminals of your lightning arrester, and if the lightning arrester is to be connected to a 1,000 volt circuit the lightning arrester should break down at about 2,000 volts. Now, the lightning arrester, as a conductor of disruptive discharges, has nothing to do with the e. m. f. of the dynamo. As far as conducting the discharge away is concerned, if we apply



FIGS. 2 AND 3.

2,000 volts to that arrangement, shown in Fig. 2, the breaking down e. m. f. will be just the same, no matter what that resistance is. You can have, say 100 ohms in connection with that spark gap, or a million ohms, and it will not make a particle of difference about the breaking down e. m. f., but the resistance will make a great deal of difference as regards the lightning. That form has been called the short-gap lightning arrester. The resistance which is connected in series with the spark gap shown in Fig. 2 is said to be a low resistance. It is low compared with what? Lightning arresters, as ordinarily installed, are connected to the overhead wire and to the ground by means of fairly large copper wires of very low resistance, not more than an ohm or so at all events, and the joints are soldered. It seems to me very curious then that in such a path we should connect a resistance of quite a good many ohms. But by what right does anybody call that a low resistance? What is the standard? The only standard for the resistance of a lightning arrester is the ease with which it will conduct disruptive discharges to earth, with absolutely no reference to ohmic resistance or breaking down e. m. f. There is a great difference between the static discharge and the dynamo current. The dynamo current is more of a gentle force and can be likened to the force of wind moving water; the lightning discharge can only be likened to the blow of a hammer or the flight of a bullet. If we have a large pane of glass ordinary wind will not break it, but a bullet would find no difficulty in piercing that pane of glass. But it is an entirely different force that we are dealing with, and as I have described, the discharge is oscillatory,

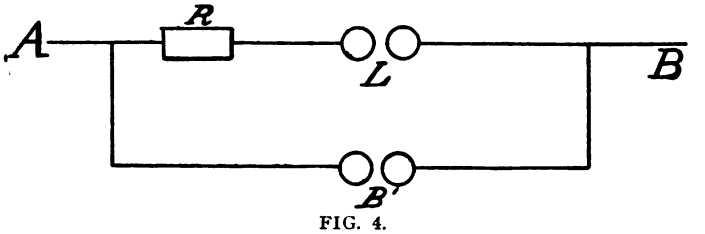


FIG. 4.

swinging back and forth. Now then, suppose that we have a swing back and forth and in the path of that swing we have a pane of glass. That swing in its first motion will smash the glass and will then vibrate back and forth until it comes to rest without further resistance, disregarding the air and speaking only with reference to this pane of glass. Now then, in the place of the pane of glass, let us substitute a vessel of water, so that this swing that swings back and forth this way will have to pass through the water. The water is not removed and this swing has got to pass through the water and meet that resistance each time. Now, I liken that water to this non-inductive resistance in series with the spark gap and lightning arrester.

[1]Abstract of a paper read before the N. E. L. A. Convention, June, 1898.

Digitized by Google

The discharge has to pass down through that resistance, up and down, up and down, each time, and the path with reference to the ease with which the discharge passes through it is hereby affected. But with the spark gap the air is smashed, the discharge bores a hole right through the air as a bolt does through jelly; the resistance is removed. The air has practically an infinite resistance as far as ohmic resistance is concerned, but this discharge bores a hole through the air and that stays there during those oscillations. That is the reason, in my mind, for saying that the equivalent spark gap, as shown in Fig. 2, is so much larger than the equivalent spark gap in Fig. 3, in spite of there being three gaps to one; so that the best path, in my judgment, for disruptive discharges is what I would call a free path, a path with any kind of resistance gap, not a restricted path, but a path which has nothing but a spark gap or several spark gaps I call a free path. The discharge will smash the air and form at once a free path for the oscillations.

EDUCATIONAL

University of Tennessee Record.

The May number of the above manual has just reached us, and contains, besides an address by President Dabney entitled, "The Making of a Perfect Man," an address by Dr. Mellen on "The Relation of the Public High School and the College," the academic announcement for the coming college year as well as numerous illustrations of college clubs and buildings. The course of electrical engineering, which is in charge of Prof. Perkins, appears to be very complete and practical, and entitles the graduate to the degree of B. S.

Purdue University.

Th annual catalogue of Purdue University, which is located at Lafayette, Ind., has just been issued, and gives information on the splendid courses offered by this well-known university. The electrical engineering course in particular, which is in charge of Prof. W. E. Goldsborough, with a large corps of assistants, is splendidly conducted and in a practical manner fits the student for electrical engineering. Particular attention is given to the designing of electric machinery and appliances, and numerous electrical installations are inspected during the senior year. The curriculum includes in the senior year besides the ordinary courses taught in colleges, a thorough course in political economy, which appears to be a valuable acquisition for a technically trained man.

Michigan Engineers' Manual.

The Michigan Engineers' Manual for 1898, containing the proceedings of the Michigan Engineering Society, has some admirable papers which were read before the society at the annual convention at Port Huron, December, 1897. The papers are as follows: "Engineers' Personal Finances," "The Sewerage of Pontiac," "Curb and Sidewalk Grades," "The Horseless Carriage," "Electrolysis," "The Propeller Wheel," recent legal decisions and other papers of equal interest and importance.

University of Minnesota.

The bulletin of the University of Minnesota, located at Minneapolis, Minn., which is issued every six weeks, contains in its April 15th number the announcement of the College of Engineering and Mechanical Arts. The college appears to have a fine course in electrical engineering in charge of Prof. George D. Shepardson. It extends over a term of four years and is practical and thorough, as are all the courses offered by this university.

University of Vermont.

The bulletin of the engineering department of the University of Vermont contains very interesting information regarding this well-known old college and its excellent courses in engineering. The electrical engineering course, which extends over four years, includes a large number of applied electrical subjects. The electrical engineering laboratories, which are illustrated in the bulletin, appear to be thoroughly and well equipped with all modern direct and alternating current apparatus, and the university has several well equipped and modern shops for the use of students.

Lehigh University.

The engineering department of the above university has just issued an interesting pamphlet containing a list of theses presented by candidates for engineering degrees. Among the electrical subjects are several of extreme interest to electrical engineers, about half of them being of the theoretical and the others of a strictly practical nature. It certainly speaks well for the high class of instruction furnished to the students of Lehigh by Dr. Macfarlane and his well-known corps of assistants.

Cornell University Physical Review.

Vol. vi., No. 5, of the Cornell University Physical Review, conducted by Prof. Nichols and Drs. Merritt and Bedell, contains among other interesting articles the following, which are of special interest to electrical engineers: "On the Surface Tension of Liquids Under the Influence of Electrostatic Induction," by S. J. Barnett; "On the Fall of Potential at the Surface of a Metal When Exposed to the Discharge Action of the X-Rays," by C. D. Child, and "An Instrumental Determination of the Period of Electrical Oscillation," by A. G. Webster.

NEWS & NOTES

Photograph of the Holy Shroud by Electric Light

IN Turin the other day, according to "Il Osservatore Romano," a photograph by electric light was taken of the Holy Shroud, which gave an admirable reproduction of the body of Christ. The Holy Shroud was recently exposed to veneration, and King Humbert, who is its hereditary guardian, at first hesitated to give authority to have it photographed, lest the photographs should be speculated in. However, his Majesty at length gave the requisite permission to Signor Secundo Pia, a lawyer and member of the Committee on Sacred Art, who had offered to photograph the Holy Shroud at his own expense. Signor Pia prepared his plates according to a special method, rendering them sensitive to the yellowish tint of the Holy Shroud by means of powerful electric reflectors. "Formerly," says "The Osservatore," "the appearance of the Holy Shroud gave an idea of the contour rather than the facial lineaments and body of Christ. On the other hand the photographs, on being developed, showed a perfect representation of the face, hands and limbs of Christ, the general effect being that of a photograph of Christ and not of his shroud."

Glass as a Conductor.

According to Maxwell's theory, ordinary conductors should be opaque to light. Electrolytic conductors do not come under this rule. If glass, therefore, is a conductor at high temperatures, the conduction must, as a first approximation, be regarded as electrolytic. A. Vosmaer, in "Electra," describes a striking experiment illustrating the conductivity of glass. Two electrodes terminating in glass rods are joined to the poles of a high-tension transformer. Nothing happens until the rods are heated by a Bunsen burner, when an arc is formed between them. The arc itself keeps the rods at conducting point, but as a rule the rods break, owing to some portion acquiring greater conductivity than the rest, and then taking all the current. If, before this happens, the electrodes are separated, a spark discharge sets in, and, on a further separation,a brush discharge. On bringing the electrodes together again the arc is re-established.

Digitized by Google

Testing Gold Quartz by the Röntgen Rays.

According to an English contemporary, an ingenious application of the Röntgen rays has recently been made, viz., to ascertain the presence of gold particles in quartz. The particles of gold in a paying gold quartz are often so finely divided as to be invisible to the naked eye. Since gold is much more opaque to the Röntgen rays than quartz, it is natural to suppose that some indication of the presence of gold in quartz would be given on the screen or the photographic plate when the quartz is traversed by the Röntgen rays. A physician in Los Angeles, California, is reported on accidentally photographing a lump of gold quartz to have found on the shadow of the outline of the quartz a number of very dark points. These points were due to the presence of particles of gold in the quartz. It is possible, therefore, to detect the presence of gold in quartz by the Röntgen rays, and it may sometimes be convenient in the laboratory, but it is not to be expected that the gold prospector will add a battery, an induction coil, and vacuum tubes to his rough and tumble kit for transportation over the Chilkoot Pass.

Nerve Currents.

F. Gotch and G. J. Burch in Proc. Roy. Soc., make a preliminary communication on the electrical response of nerve to a single stimulus, which they have investigated with the capillary electrometer. The form of stimulus employed was a relatively feeble induced current caused by the opening of the primary circuit of a standardized induction coil, which included one Daniell cell. The sciatic nerves of large frogs were used in all the experiments. The single stimulus was applied to the sciatic plexus 20mm. or 30mm. from the nearest of the electrometer contacts. The shock traveled along the nerve, past a pair of unpolarized electrodes joining the electrometer, and was followed by the nerve current in rapid succession. The exciting current also showed on the photographic record, but could be easily distinguished from the larger nerve current. The recording plate was attached to a pendulum motor, which also opened the primary circuit of the induction coil. Some of the nerves used were freshly prepared, other had been kept in the cold from 24 to 90 hours in 0.6 per cent. NaCl solution. The two sets of nerves showed marked differences. In the fresh nerve the first indications of the presence of the reaction occur 0.002 sec. after stimulation. The decline commences 0.001 sec. after that. In the kept nerve the loss of vitality is shown by a retardation both of the initial change and the rate of propagation. The latter falls from 10 or 15 to 6m. per second. When a certain length of the nerve is polarized by a slight constant e. m. f. the reaction differs according to the sign of the pole nearest the electrometer. The actual e. m. f. of the nerve current may be put as high as 0.032 volts. This fact is suggestive in view of the various theories of the electrical organ of fishes. It may be a nerve apparatus.

Telephones and Liquid Air.

Mr. Henry Norman, the well-known English journalist, in a recent article entitled "America Revisited in War Time," speaks as follows regarding the use of the telephone here and in England: "The observant visitor to America must be impressed first with the remarkable development of what may be called applied intelligence. Not only is there an extraordinary fertility of invention, but also, what is perhaps more striking still, there is apparently an instant readiness on everybody's part to make use of the things invented. . . . .

"From visit to visit, for example, I have observed a constant improvement in the telephone. The instrument has grown smaller, neater, more graceful, simpler and easier to use. As it stands on an American desk to-day it might by a flower-holder. In some of the best and most expensive parts of London to-day you cannot have a telephone put in your house at all. When you do, it is the ugly box arrangement of ten years ago. I called upon a journalist friend in New York. Upon his desk stands an elegant little apparatus, through which he converses every afternoon with Washington and Chicago. In a London newspaper office you might as well look for a machine for making liquid air."

OBITUARY

Dr. Cornelius Herz.

THE death has been announced of this well-known man, who was at one time largely interested in electrical matters in this country and in Europe, and who sought shelter in England at the time of the Panama Canal scandal, with which his name was unpleasantly linked with that of Baron Reinach. Sir Edward J. Reed, in an article in the "Fortnightly Review" for January, 1897, said, in reference to Dr. Herz's case: "His vindication as a man of honor was bound to follow, and has now become an accepted fact in this country and elsewhere; the tribute of "The Times," of London, that 'Dr. Herz is a great man,' will be acquiesced in and endorsed throughout the world, and France, until she makes such amends as may be possible, must bear the reproaches of the civilized world. If a private citizen had inflicted such wrongs on Dr. Herz a court of justice would order a restitution of all extorted property, and would award him exemplary damages. Can a government, however mighty it may appear, be allowed to escape such a responsibility? It is to be hoped that Dr. Herz, if health permits and life lasts long enough, will endeavor to have this question answered."

LEGAL NOTES

Railway Motor Suspension.

The Walker Company has sent out a special circular, accompanied by a special letter from Vice-President Short, calling attention to a letter recently issued by President Coffin, of the General Electric Company, as to the Sprague motor suspension patent and the effect of the recent decision sustaining said patent. Prof. Short's letter and the circular traverse the statements made by President Coffin, and characterize them as "wilfully misleading," and the letter adds: "The motor suspension now used by the Walker Company is not the suspension that came to trial, and the statement made in the letter that 'practically every form of motor suspension now in use' is an infringement of patents controlled by the General Electric Company is erroneous." The Walker circular illustrates the difference by diagram and enumerates the points of dissimilarity.

Western Elec. Co. vs Am. Rheostat Co.—Motor Cut Out.

Judge Seaman, in the U. S. Circuit Court for the Eastern District of Wisconsin, has granted an injunction against the American Rheostat Company in favor of the Western Electric Company, suing under the U. S. Patent No. 565,867 of E. P. Warner, on a cut-out for electric motors. The defendants contended that the definition in claims 1, 2 and 3 as to the combination with a rheostat included in the armature circuit and provided with a contact arm adapted to be moved to cut in and out resistance, of a switch in the same circuit, independent of said contact arm, referred solely to the feature of the covering, which rendered the switch inaccessible to the operator. Barton & Brown and A. L. Lawrence appeared for complainant and Winkler, Flanders, Smith, Bottum & Vilas for defendants.

COLUMBUS, O., has become famous for its electric light arches across its High street. It was proposed to abandon them on account of the expense, but as the electric light company has reduced its price, the city authorities will stand part of the expense, and the merchants are willing to meet their part of the assessment. The arches are not only pretty to look upon, but have been a fine "ad" for the city itself.

Digitized by Google

INVENTORS RECORD

Classified Digest of U. S. Electrtical Patents Issued July 12, 1898.

Alarms and Signals:—

AUTOMATIC FIRE EXTINGUISHING AND ALARM APPARATUS. H. Eversmann, Cincinnati, O., 607,027. Filed Aug. 21, 1897. Designed to be used in connection with a pipe system which is normally empty and provided with a main supply valve which controls admission to the pipes accordingly.

SWITCHBOARD FOR ALARM MECHANISM. J. P. Conway, New York, 607,343. Filed May 5, 1897. Details of construction.

ALARM SYSTEM. C. Coleman, Chicago, Ill., 607,407. Filed Oct. 18, 1897. Means whereby localized portions of an electric protective circuit may be varied in character to prevent tampering with the circuit without sounding an alarm at the alarm station.

ELECTRIC SIGNALING MECHANISM. L. G. Rowand, Camden, N. J., 11,678, reissued. Filed December 15, 1897. Means whereby the repeating of a signal on the main line to branch lines is made positively automatic.

Batteries, Secondary:—

ELECTRODE PLATE FOR ELECTRIC ACCUMULATORS. P. F. Ribbe, Berlin, Germany, 607,078. Filed Jan. 25, 1898. Comprises a lead pipe, having openings, celluloid bars on each side of the plate, and connected together through the openings, the bars having undercut edges holding the active material.

AUTOMATIC CUT-OUT FOR SECONDARY BATTERIES. W. L. Negbaur, Brookline, Mass., 607,124. Filed Feb. 10, 1897. Comprises a magnet core provided with a non-polarized armature, a working circuit controlled by the armature, and two coils on the magnet core wound and connected to oppose each other, the armature being operated by the differential effect of the coils.

Conductors, Conduits and Insulators:—

UNDERGROUND ELECTRIC CONDUIT. T. Connelly, Chicago, Ill., 607,018. Filed Nov. 12, 1897. Composed of a series of tubes laid coaxially, the tubes being chamfered on their ends, and an unbroken, corrugated, metallic ring over the joints, for holding the tubes in line.

ELECTRIC CABLE FOR DRIVING CONVEYANCES. A. Norman, Toronto, Can., 607,070. Filed April 19, 1897. Consists of continuous positive and negative conductors, insulating material between and surrounding the conductors, and a switch for each conductor attached to and surrounding the cable.

INSULATOR. C. L. Wingard, Walla Walla, Washington, 607,315. Filed April 13, 1898. A tube divided into longitudinal sections, each of which has interlocking shoulders and a head at its outer end, so that the sections may be fitted together to form a continuous tube.

Dynamos and Motors:

ELECTRIC MOTOR. W. S. Johnson and H. Winkenwerder, Milwaukee, Wis., 607,247. Filed Nov. 9, 1896. A simple compact motor for various kinds of light work that can be operated with a few cells of battery.

Measurement: -

ELECTRIC METER. W. D. Marks, Philadelphia, Pa., 607,185. Filed Nov. 4, 1897. An electric meter employing an ampere-indicator, a shaft, connections between the shaft and the indicator, and a supplemental pointer carried by the shaft.

Miscellaneous:—

APPARATUS FOR MANUFACTURING OZONE. E. Andreoli, London, Eng., 607,007. Filed Oct. 15, 1897. For description see page 539, issue of May 19, 1898.

ELECTRICALLY HEATED ROLL. F. P. Snow, Lynn, Mass., 607,093. Filed May 3, 1897. Consists of an annular core, wound with a primary conductor, and contained in a rotary shell, which forms the choking portion of a secondary circuit about the same core.

ELECTRIC BREAK FOR INDUCTION COILS. T. B. Kinraide, Boston, Mass., 607,176. Filed Feb. 26, 1897. A high speed break comprising a vibrating hammer, an anvil, a standard supporting the anvil, and a brace rigidly secured between the standard and the frame of the break.

ELECTRIC BREAK AND INDUCTION APPARATUS. T. B. Kinraide, Boston, Mass., 607,177. Filed July 26, 1897. Similar to above.

ELECTRIC CURRENT CONTROLLER. E. E. Werner, Philadelphia, Pa., 607,311. Filed Feb. 23, 1897. A measuring instrument used principally in cataphoresis or electromedicamental diffusion.

Railways and Appliances:—

TROLLEY FOR THIRD RAIL. L. M. Maxham, Boston, Mass., 607,065. Filed Sept. 1, 1897. Provides bearings for the trolley wheel adapted to resistingly permit a slight canting of the same, and means whereby such canting automatically guides the wheel toward the centre line of the third rail.

TROLLEY. W. H. Russell, Chicago, Ill., 607,194. Filed May 24, 1897. Details of construction.

ELECTRIC RAILWAY. W. W. Doty, New York; J. A. MacKnight, Mt. Vernon, and C. Grauten, New York, N. Y., 607,351. Filed Jan. 25, 1897. Sectional underground conduit system.

TROLLEY FOR ELECTRIC RAILWAYS. H. Van Hoevenbergh, New York, 607,387. Filed Aug. 31, 1897. Is provided with a plurality of wheels set at right angle to bear upon a supply conductor at their peripheries, the wheels being mounted in a frame provided with projections lying close to their sides to prevent spreading.

ELECTRIC LOCOMOTION. H. Van Hoevenbergh, New York, N. Y., 607,302. Filed Nov. 20, 1896. Employs an outgoing and return conductor adapted to be transversed by trolleys carried by a vehicle having electric motors but not traveling on rails.

Regulation:—

METHOD OF AND APPARATUS FOR GENERATING ELECTRICITY. W. L. Negbaur, Brookline, Mass., and J. J. Feely, Walpole, Mass., 607,125. Filed June 17, 1897. Provides a dynamo in connection with other means which controls the voltage of the whole system automatically without substantial change of its own voltage.

Switches, Cut-Outs, Etc.:—

ELECTRIC CUT-OUT. H. A. Lewis, Norristown, Pa., 607,250. Filed July 14, 1897. Comprises a tube, a non-conducting rod held removably in the tube, a wire coiled on the rod, caps held in the ends of the rod, spring contact plates engaging the caps, and a circuit breaker operated by the expansion of the tube.

FUSE HOLDER, CIRCUIT BREAKER AND LIGHTNING ARRESTER. H. A. Lewis, Norristown, Pa., 607,251. Filed July 14, 1897. Details of construction.

Telegraphs:—

TELEGRAPH. L. W. Hildburgh, New York, 607,239. Filed June 2, 1897. Employs a main line and a source of alternating current therefor, and means for controlling the flow of the positive and negative impulses from the generator by short circuiting one set of impulses at the time of generation of either set of waves, the other set being unaffected.

THE STOCK MARKET

Favorable Conditions.

An export trade that is just double the import trade must be a tolerably healthy basis on which to do business and accumulate money, and that is just what the U. S. A. did in the year ending June, 1898. Such conditions may not be readily repeated, but they bring encouragement and confidence, and there is no wonder that preparations for the Fall are reported to be on a large scale. Moreover, the victory of our army at Santiago has been no less decisive and convincing than that of the navy at the same place and at Manila, and it is now evident that the losses of the war will not be upon us, but that we shall secure a solid indemnity. All this makes for a strong market, and to it may be added the large gold finds now coming in from the Klondike. The Government bond issue is a great success, being subscribed five or six times over.

During the past week 11,498 shares of Western Union were sold, closing at 92¼, and 6,835 shares of General Electric, closing at 38⅜, a decline from 40¼. In Boston American Bell Telephone sold at 275.

Copper, New York, sold at 11.65 cents, and heavy steel rail, Eastern mill, at $17. The Third Avenue Railroad, New York, has received bids for 15,000 tons of rail and special work.

REPORTS OF COMPANIES

Sale of Brooklyn Edison Co., To Kings County Co.

Official announcement is made that George Foster Peabody, of the Board of Directors of the Edison Electric Illuminating Company, of Brooklyn, acting in concert with the officers, has closed a proposed sale of the stock of that company to the Kings County Electric Light and Power Company upon terms which the members of the Board of Directors unite in declaring to be for the permanent advantage of the company. This transaction is in behalf of the stockholding interests represented by the firm of Spencer, Trask & Co., and equally for all others. The deal will probably be consummated by October 1. The result to the stockholders will be in substance that the right to subscribe to 25 per cent. additional stock, at par, will be secured to them, and that for the whole amount of stock they will then be offered par in ninety-nine year 6 per cent. purchase money mortgage bonds, to be secured by the deposit of the Edison stock so sold, and additionally by a junior mortgage of the Kings County Company upon its property, and further by the deposit of a guarantee fund of $1,000,000."

MR. D. McREYNOLDS has been appointed superintendent of construction of the South Texas district of the Southwestern Telephone and Telegraph Company, with headquarters at Austin, Tex. He moves from Houston.

CINCINNATI, O. The Edison Company's plant has had a bad fire, starting in the engine room and causing considerable damage, although the supply of current was maintained with creditable promptitude.

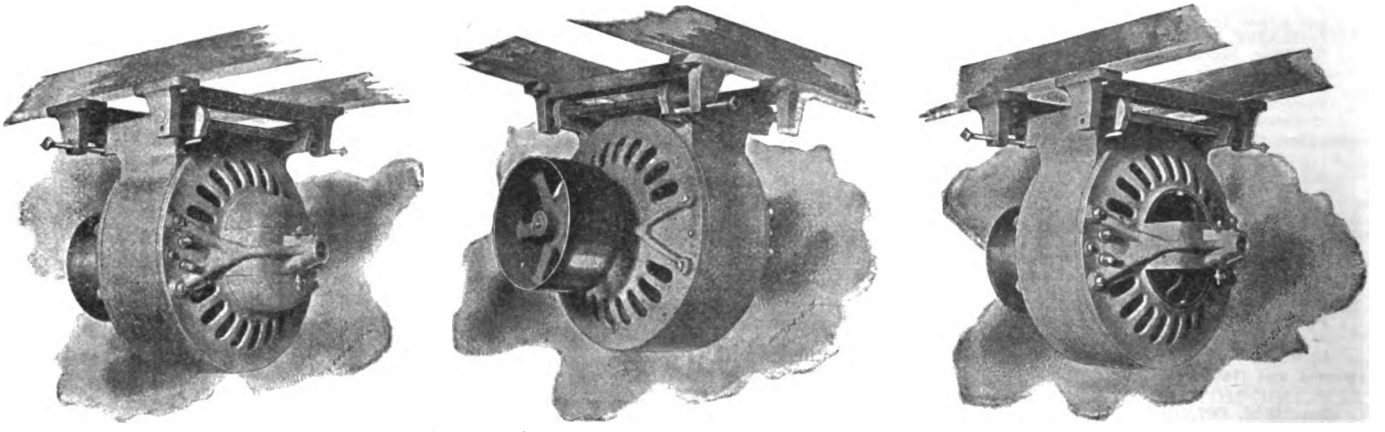
Digitized by Google

TRADE NOTES AND NOVELTIES

The Commercial Electric Co's. Iron Clad Motor.

WE illustrate herewith the new ironclad motor which has recently been brought out by the Commercial Electric Co., Indianapolis, Ind. They are built for two standard speeds and are intended for a variety of uses. In Figs. 1, 2 and 3 they are shown mounted on the ceiling. The magnet frame is of steel with circular cores and pole shoes of the same material, thus affording a low resistance air gap and the greatest possible efficiency of the magnetic circuit, while the end casings which carry the bearings are of cast-iron and are provided with ample ventilating holes. The workmanship and material throughout are of the highest class. The shafts are of steel and bearings self-oiling with bronze linings which are easily renewed. Carbon brush holders of simple construction and large capacity are used, and owing to the strong magnetic field sparking and change of lead are avoided, so that the machines may run for a long time and require little attention.

They are thoroughly protected from mechanical injury, dust and dirt, while the large lids which are placed in the casing above and below the commutator allow of easy access to the brushes when desired. When suspended as shown in the cut, the operation of the belt tightening device is in no way interfered with or more inconvenient than when mounted on the floor, since there are no bolts to be loosened, but the machine can be mounted on its own support as with other ceiling machines. It is extremely convenient for direct belting to elevator machines when used in this way and the company makes a special reversible motor and controller for this purpose. The machine, it is needless to add, runs equally well if placed on the floor or regular foundation. The company will be glad to answer any inquiries on the subject.



FIGS. 1, 2 AND 3.—"COMMERCIAL" IRONCLAD MOTOR.

Raritan Copper Works, Perth Amboy, N. J.

The development of electrolytic processes for the production of refined copper has proceeded very rapidly during the past three years, and at the present time a large proportion of all the refined copper is thus produced. The Westinghouse Electric and Manufacturing Company have installed a very large amount of apparatus for this class of service. One of the principal installations is at the refinery of the Anaconda (Mont.) Copper Company, where 10 generators of 270 to 300 kilowatts capacity have been installed. Another very large installation is that of the Boston and Montana Consolidated Copper and Silver Mining Company, Great Falls, Mont., where two 810 k. w. Westinghouse engine type generators are in service.

The latest comer in this field is the Raritan Copper Works of Perth Amboy, N. J., who are about to erect the largest copper refinery in the East. They have contracted with the Westinghouse Company for three 600 k. w. 150-volt engine type generators, 150 r. p. m., with a 9-section switchboard, for electrolytic service and the operation of two 75 k. w. 220-volt engine type generators, which will be used for lighting and power service. The installation will be the most complete of its kind in the world.

The Solar Carbon and Manufacturing Company, Pittsburg.

IN the practical application of electricity for any purpose, carbon plays an important part. It is generally a factor in generating the current either by mechanical or chemical means, and is also a factor in its consumption or transformation, either for light, power, heat or for electrolytic purposes; and it is a curious fact, but not generally noted, that while the electric arc light has superseded petroleum oil to a large extent for illuminating purposes, the current cannot produce its light without burning a carbon pencil, which is usually made from a by-product produced in the process of refining this same petroleum oil. Consequently the manufacture of carbon, or rather the conversion of the crude material into special form for any purpose, is a comparatively new business, and gave rise in 1885 to the corporation named in this connection. The works of the Solar Carbon & Manufacturing Company are located at Mahoning, sixty-two miles up the Allegheny River from Pittsburg, the location having been chosen because of its proximity to the natural gas fields, which at the time promised to furnish cheap fuel for the baking process, constituting the chief expense in the manufacture of finished carbon. In the manufacture of the various specialties turned out from these works, the process includes the grinding, bolting, mixing, moulding or forcing the plastic material into the required shapes, a process which was recently described in detail in these columns. The works of the company embrace six buildings, which are located on a tract of 100 acres. They are equipped with special machinery, and with calcining and baking furnaces, also of special construction. The equipment also includes engine power in two units for operating the same. The products embrace pencils, both solid and cored, for every known system of lighting; brushes for generators and motors, chemical battery cylinders of various forms, smelting rods, tubes, telephone parts and granules for telephone transmitters. The latter are made in four grades and of twenty-eight sizes. Among the specialties manufactured by this firm, are self-lubricating motor brushes, in which the lubricating feature is obtained without the use of graphite, the brush being pure carbon specially treated, which gives the desired results, and does not increase the resistance, as is the case with the graphite mixture. Another specialty, recently brought out, and in which the company controls the trade, are pencils of particularly fine grade, practically as smooth as graphite, and which are designed for use in the numerous chemical and refining plants that are springing up in the neighborhood of Niagara. The composition of these conductors is such that acids play no part in their destruction, consequently they have a life four or five times as long as some of the foreign made carbons, and are now even being exported for use in similar works abroad. Among the specialties that are remarkable chiefly because of their size, are smelting rods, some of which are solid cylinders 8 inches in diameter and 54

Digitized by Google

inches in length. The company do not, however, limit the forms or grade of their products to catalogue lists, but are always ready to design moulds or dies for any special forms that may be required. They will make anything that can be made from carbon, except diamonds of course, but they will probably make them as soon as anybody else. The products of the concern go to all parts of the world where electricity is used as an applied art, and are claimed to compete favorably with the best of foreign products in any line. The city office of the company is at 339 Fifth avenue, and the practical management of the business is in the hands of F. B. Laughlin, general manager, and his son, F. M. Laughlin, treasurer.

Repairing a Railway Generator Armature, Cleveland, O.

THE illustration herewith shows the power station on Cedar avenue, of the Cleveland Electric Railway Co., and the process of rewinding one of their 500 kilowatt generators by the W. H. Elliott Electric Co. of Marine Block, that city. The generator is the third that has thus been wound for the Railway Company this year by the Elliott Co., who do all their generator repair work, and who have exceptional facilities for handling heavy electrical jobs of that character. Their trade extends from Oregon to Florida, as they have just shipped two large armatures to the Salem, Ore., Consolidated Co., and have also done some work for Jacksonville, Fla.; while they are also busy on local work, including an M. P. 100 for the New York & Ohio Co., of Warren, O.

The business of the W. H. Elliott Co. is that of rewinding

500 K. W., G. E. MOTOR BEING WOUND BY THE W. H. ELLIOTT ELECTRIC CO., FOR THE CLEVELAND, O., ELECTRIC RAILWAY CO.

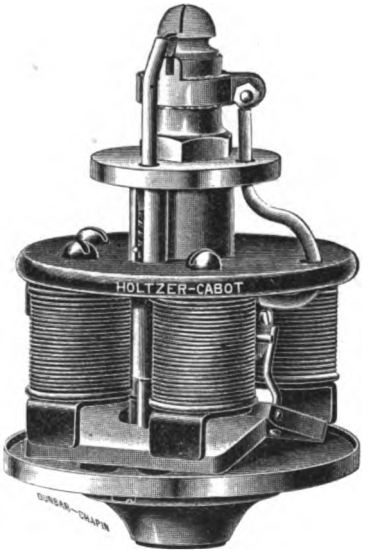
armatures, fields, transformers, etc., refilling commutators and making new ones; building new armatures, etc., for all classes of electrical machines, and doing experimental work. They are at present running day and night shifts, and expect to do so for some weeks to come on the orders now in hand. Mr. Cartwright, the president of the concern and its manager, was one of the two men who started what is said to be the first dynamo and motor repair works in the United States, giving its entire attention to that class of work. From that time—June, 1887—to the present, he has devoted his time and energies in the same direction, and the result is seen in the successful work and continuously growing patronage. Mr. Hankey, the secretary and treasurer, who has charge of the clerical force, is a new man in the electrical field, but is rapidly making a large circle of friends and acquaintances.

The "Monarc" Enclosed Arc Lamp.

The firm of Albert and J. M. Anderson, of 289 A street, South Boston, Mass., have brought out a number of valuable lines of apparatus in the electric railway and other special fields, and are now introducing another novelty in their "Monarc" enclosed arc lamp, which is shown herewith. The lamp is only 22 inches over all, and burns carbons ½ inch by 12 inches. The standard lamps of this style require 4¾ amperes, but can be furnished to take 3 or 4 amperes if so desired. There are a number of interesting and novel features, all intended to make the lamp economical and efficient. The work of trimming has been made very easy, there is good contact for the carbon, and the best shape for the inner globe has been determined after many experiments on light, and with a view to the minimization of breakage. The magnets and all other parts of the lamp are easily removed and replaced, and all mechanical details have been worked out with great care and attention. The "Monarc" lamp is furnished with alabaster inner and clear outer globes, unless otherwise ordered. It is rated to burn for 150 hours on one trimming. Class A lamps are designed for 110 volt circuits with a range from 105 to 118 volts, and with 6½ ohms resistance to each lamp. Class B lamps are designed for multiple series lighting on street car circuits, ranging from 200 to 1,000 volts, 6½ ohms resistance per lamp. The firm are now pushing this lamp actively and will be pleased to receive inquiries and orders.

Improved Holtzer-Cabot Automatic Burner.

THE Holtzer-Cabot Electric Company, Brookline, Mass., have recently made a neat improvement in their well-known automatic gas burner. This consists of the addition of extended pole pieces or shoes which reach down almost to the outer edge



IMPROVED HOLTZER-CABOT AUTOMATIC BURNER.

of the armature, extending the magnetic field and making it more effective. It will be observed that a stronger action is now obtained, even with less battery, than was formerly required, as the air-gap between the armature and fields has been almost closed.

Extensive Additions to Walker Company's Plant.

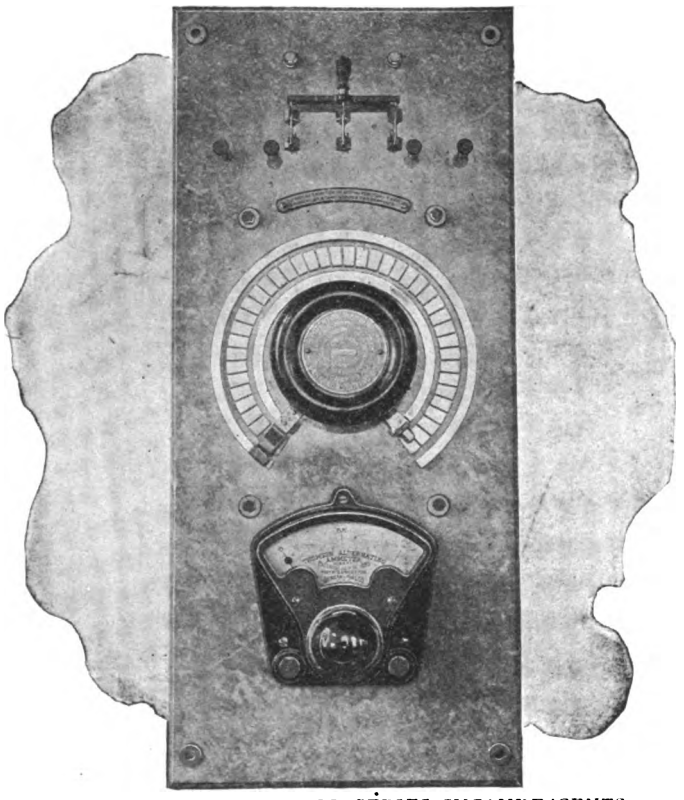
The Walker Company, on account of rush of work and consequent need of additional space, has found it necessary to add to the large machine shops it already possesses at the Cleveland works. These machine shops alone consist of three bays, each 400 feet long, and the addition will consist of a fourth bay. Work is being rapidly pushed, and the new bay will be shortly completed and ready to receive the large machine tools which are to be placed there.

Digitized by Google

G. E. Compensator for Series Incandescents.

ONE of the great obstacles with which the series system of incandescent lighting has had to contend has been its want of flexibility. If the circuit is laid out for the full number of lamps which the normal voltage will operate, a means must be provided for increasing the voltage to take care of additional lamps ordinarily called for for a short time. On the other hand, if only a part of the possible number of lamps are connected in circuit, expensive or complicated arrangements are necessary to absorb the surplus voltage.

For satisfactorily controlling the voltage, the General Electric Company has developed a form of potential regulator especially adapted for this work, by the use of which the series system becomes almost as flexible as a parallel system, and the power consumed in the circuit varies directly in proportion to the number of lamps in use. A regulator panel, with ammeter, switch and fuses, is shown in the illustration. The regulator is mounted on the back of the panel and consists of a compensator, from the secondary winding of which taps are connected to a set of contact blocks arranged in circular form on the front of the board. A hand wheel in the centre of the ring of contacts operates two arms carrying brushes which connect from the contact blocks to continuous rings on the inside and outside of the contact blocks. One of these arms is connected directly to the hand



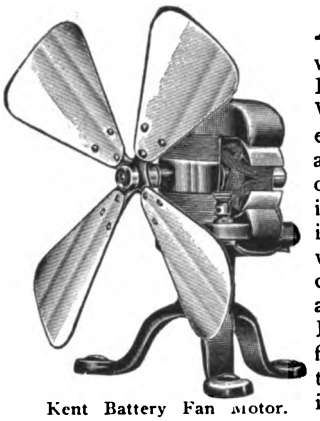
G. E. COMPENSATOR FOR SERIES INCANDESCENTS.

wheel, the other is connected through a bevel gear, so that the direction of rotation of one arm corresponds to that of the hand wheel, while the other moves in the opposite direction.

The compensator is so connected that whatever difference of voltage exists between the two concrete rings on the dial switch is added to or subtracted from the initial voltage of the circuit. If one arm be directly over the other, there is no difference of potential between these rings. If the hand wheel be turned to the left a gradually increasing voltage which will be added to that of the line will be developed between the rings, while a gradually increasing voltage, which will be subtracted from the initial voltage, will be developed if the hand wheel be turned to the right. The ammeter below the hand wheel indicates the current in the circuit. When the number of lamps in circuit is changed it is simply necessary to turn the hand wheel until the proper current is indicated.

The compensators are wound for the standard currents of 3, 5 and 5.5 amperes, and in either case will increase or decrease the initial voltage of 1,150 or 2,300 by 230 volts. Special regulators giving a greater range of voltage will be built if desired.

Kent Battery Fan Motor.



Kent Battery Fan Motor.

A CONCERN which has enjoyed considerable success with its fan motors is the Kent Electric Manufacturing Co., of Worcester, Mass., which is still extending its line of specialties and novelties. It has now brought out a new battery fan corresponding to its Type C of last year and intended specially for battery work. It is well shown in the accompanying cut, and is evidently a strong, compact little machine. It carries a 10-inch fan, and the finish is black enamel, with nickel trimmings. The one bearing is 3 inches long and is part of the field magnet frame at the neutral point, so that there is no bother with bearings to adjust and the shaft does not bind or get out of alignment. Moreover, as there is no bearing at the commutator end, that important part of the motor has no likelihood of being clogged or partially insulated by trickling oil. The armature is of the Kent drum type, such as has been in use now for two years, and it runs with great smoothness, quiet and efficiency. The binding posts for the attachment of the battery wires are placed, as will be noted, in a convenient position alongside the field coil. The Kent Company is doing well with this motor and will be glad to receive correspondence and inquiries in regard to it.

Manufacturers' Building, Providence.

One of the largest and best equipped power buildings in the United States is the Manufacturers' Building, Providence, R. I. This building has accommodations for upwards of sixty manufacturing concerns, being particularly equipped with conveniences for the production of jewelry, specialties, etc. The Manufacturers' Building Company have just purchased a 250 k. w., 500 volt Westinghouse engine type generator, 100 r. p. m., to be driven by an Armington & Sims Corliss engine. This generator will supply power for the operation of motors in the various manufacturing departments of the building. The engineering features of this establishment are under the direction of Lewis & Claflin, consulting engineers, whose wide reputation for engineering installations of the highest order is borne out by their selection in this instance.

Pelton Water Wheels.

The Pelton Water Wheel Company, of San Francisco, Cal., report a very active business at both their San Francisco and New York works. The war has affected to some extent their export trade, still this on the whole is very satisfactory. Electric power transmission plants are still a prominent feature in the work of this company. Among their more recent contracts are the following: A 1,200 h.p. plant to operate the Odawara Electric Railway in Japan, wheels to run under 400 feet head; 650 h. p. plant to operate a cotton factory in Japan; 500 h. p. wheel for the Blue Lakes Electric Power Plant in California; 800 h. p. plant for the Auburn station of the Central California Power Company; 1,500 h. p. plant for the Tuolumne Electric Power Company, California; 750 h. p. plant for the Griffith mine, Tuolumne county, California; 250 h. p. plant for the Ventura Electric Light and Power Company, Cal.; 1,200 h. p. plant for a railway company in British Columbia; 250 h. p. plant for the Salt Lake & Ogden Railway Company; 300 h. p. plant for the Farfan Electric Power Company in Peru; 7 wheels for the California Powder Works, Santa Cruz, Cal.; 4 wheels for air compressor plants in Alaska; 2 wheels for various mining companies in Alaska and British Columbia; 3 wheels for Central America; 7 wheels for various mining purposes in Mexico; 13 wheels for various mining purposes in Utah, Montana and Idaho.

THE BALL ENGINE CO., Erie, Pa., have recently received orders for several engines from Mexico.

Digitized by Google

The Campbell & Zell Company, Baltimore.

THIS company are closely allied to the electric industries of Baltimore in that they have built the boilers for all but two of the street railway and electric light power stations. They have also supplied the boilers for twenty-five or more railway power and electric light stations in different parts of the country. The special type of boiler adapted to this particular service is known as the Zell improved water tube safety boiler, which is manufactured by the above company at their extensive boiler and marine works located at the foot of Wolfe street, Baltimore, occupying the whole of a large sized city block, having a water front of about 1,500 feet. These shops are equipped with the latest improved machinery, and the business of the company is not limited to the manufacture of the Zell boiler, but they turn out high grade tubular boilers, Scotch marine boilers, marine engines, propeller wheels, stacks, steel tanks of every description and various other work of a similar character. The foundry of this company is located a few blocks from the main works, and is one of the largest and most complete in the South, being also equipped with modern tools and having a large pattern shop, the company doing a large business in light and heavy gray iron castings.

Regarding the features of the construction of the boiler, it rests on two saddles placed under the mud drum at the rear lower end, and on a roller carried by the arch plate over the fire doors at the front end, thus relieving the nippled joints from the weight of iron and water which intensifies the action due to the alternate expansion and contraction of the parts.

The water drums are placed parallel to the incline of the water tubes, and the feed water is introduced at the rear lower end of the drum, from which point it naturally descends into the rear headers to be distributed among the tubes. The greater part of the impurities will naturally be precipitated at once from the feed water on its contact with the hot water in the boiler, and will collect in the mud drum below; and the remainder is deposited there by the succeeding passages of the water through the rear headers, due to a rapid and free circulation.

The sections are made up with rhomboid headers at the ends, each containing four tubes, and the hand hole plates covering the tubes are placed on the inside, thereby having the steam pressure holding the joints tight at all times. These joints are milled on the inside, and the hand hole plates are milled off, making a perfect joint. One of the main features of the Zell boiler is the superheating arrangement consisting of separate drum and superheating tubes. These tubes are composed of the best quality lap-welded wrought iron and extend from the manifold to the steam drum in the rear. They are placed in a single row, and are expanded at their ends into both the manifold and steam drums. The steam, after disengaging itself from the upper end of the water drum, passes into the superheating tubes, where any entrained water is evaporated, from thence into the steam drum. The drum is exposed to the hot blast about three-fifths of its own circumference, thus insuring perfectly dry, superheated steam.

Ohio Electric Specialty Co.

The above concern, of Troy, O., who have long made a specialty of dynamo and motor brushes, write us that the Perfection brush manufactured by them is the result of the ideas of inventors and designers now associated with them, and they trust that "all cheap imitations of this type of brush placed on the market by parties claiming to be the designers will be spurned by all intending purchasers." Mr. J. R. Simpson, of the Ohio company, says that they make a point of not sacrificing quality for price and that all their improvements are made available to customers as quickly as possible and as circumstances demand. Their woven wire brushes are well known to the trade and have secured on their merits a position which Mr. Simpson hopes and expects to maintain.

MR. H. A. WAGNER, of the St. Louis, (Mo.) Edison Company, has been an Eastern visitor the past fortnight, staying at Asbury Park and transacting a large amount of business between whiles.

THE WESTERN ELECTRIC COMPANY recently mailed to the trade copies of its tool catalogue No. 3. If any reader of The Electrical Engineer failed to receive a copy, one will be sent upon application.

CATALOGUES.

Stone & Webster.

Only a few weeks ago we had occasion to call attention to a very instructive power station test report issued by the above firm, and we are just in receipt of another very interesting production of these enterprising engineers. It consists of a little cloth-covered book containing, besides a long list of properties examined and reported upon by Stone & Webster, several tables of Boston and Massachusetts street railways, accompanied by valuable statistics. These tables will be of special interest to investors and street railway men, and will be sent to anyone on application to Messrs. Stone & Webster, 4 Postoffice Square, Boston, Mass.

The Electric Storage Battery Co.

Circular No. 41, entitled "The Installation of Cloride Accumulators in the Waldorf-Astoria Hotel, New York," has just been issued by the Electric Storage Battery Company, of Philadelphia, Pa. It is illustrated by large half-tone cuts of the hotel, some of the cells as they appear in the battery room, ammeter charts illustrating the method in which the battery performs its functions as a regulator, the large, handsome switchboard installed and the 20 k. w. motor-driven differential booster. The pamphlet is a useful one, and aptly illustrates the application of storage batteries to isolated plants.

Ball Automatic Cut-off Engines.

ONE of the handsomest engine catalogues ever received by us is the latest issued by the Ball Engine Company, of Erie, Pa. Within a handsome cover, ornamented by numerous incandescent lamps and an embossed likeness of Hero of Alexandria's engine, we find a volume of valuable information on engines for electric lighting, electric railways and general manufacturing plants. The catalogue contains beautiful half-tone illustrations of the company's factories, their awards, direct connected engines, the single cylinder, centre crank railway engine, portions and sections of the various Ball engines, the single cylinder engine, the cross compound engine, as well as the well-known tandem compound and vertical cross compound engines. All this is accompanied by interesting descriptive matter and essays on electric lighting, electric railways and mining, factory and mill service, etc. In the back of this very handsome catalogue, which is a model of modern typographical excellence, are complete tables of the numerous styles of engines manufactured by the Ball Company. The catalogue is called H, 1898, and will be mailed to anyone on application.

Edison Mfg. Co.

A neat and dignified catalogue in handsome red cover has just been issued by the Edison Manufacturing Company from its new headquarters in the St. James Building, Broadway, this city. It is a pamphlet of 68 pages, and its text and cuts are up to date as to all the latest developments and apparatus of this progressive concern. We note a variety of fine Röntgen-ray apparatus and the new line of electro-therapeutic specialties, all of which are well illustrated and described, including the beautiful Edison sinusoidal alternator for medical use, the Edison-Heiman electrical centrifuge, etc., the new combination cabinets, etc.

SUPT. ALDRIDGE, of the State Department of Public Works, has written to the E. G. Bernard Co. a warm letter of commendation on their recent wiring work at the Capitol at Albany, noted in our columns last week. He is evidently much impressed with the skill and energy displayed by this enterprising concern.

CENTRAL ELECTRIC COMPANY, of Chicago, are carrying in stock large quantities of wooden and iron pins and brackets, and glass insulators. They have considerably augmented their previously large stocks and are prepared to take orders of any size.

Digitized by Google

ADVERTISERS' HINTS

THE RELIABLE ELECTRIC MANUFACTURING CO., 86 Foster street, Worcester, Mass., call attention to their complete line of telephone instruments, apparatus, etc. They guarantee all they ship.

THE ELECTRIC GAS LIGHTING COMPANY, 192 Devonshire street, Boston, Mass., advertise annunciators of the finest quality and the lowest price.

THE DEARBORN DRUG AND CHEMICAL WORKS, Chicago, have over 15,000 analyses of boiler water on file. Their method is to prescribe a special compound to suit each individual case.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, are now issuing their general catalogue No. 12. It is to be had for the asking by anyone in the trade.

THE AMERICAN IMPULSE WHEEL COMPANY, 120 Liberty street, New York, say the Cazin water wheel is giving satisfaction wherever used for power transmission and the hundred other uses to which it can be put in large and small units.

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION, 120 Liberty street, New York, continues the publication of valuable data in its "ads." Many of these tables have never been compiled before, and they are well worth preserving.

WESTERN NOTES

M. C. BULLOCK MANUFACTURING COMPANY, of Chicago, as manufacturers of the Bullock-Willans central valve engine, request us to call attention to the fact that such is the engine's full designation. In our issue of July 7 we illustrated and described it under the name of the "Bullock central valve engine," and the company are desirous that the proper designation shall be the one by which it is familiarly known to the public.

THE ADAMS BAGNALL ELECTRIC COMPANY, of Grand Rapids, Mich., has been formed, with a capital stock of $225,000.

THE COLBY ELECTRICAL MANUFACTURING COMPANY, of Chicago, has certified to a change of name, which certified to a change of name to the Wells Goodhue Company. Our admirals are being furnished with a full line of their specialty for use in operating against Spanish fleets.

THE BALLARD ELECTRIC COMPANY, of Chicago, has certified to a change of name to the Wells, Goodhue Company.

WESTERN ELECTRIC COMPANY has incorporated in the State of Michigan, with a capital of $1,000,000, with headquarters at Detroit.

COLUMBIA LAMPS. Mr. A. C. Garrison, secretary of the Columbia Incandescent Lamp Company, of St. Louis, states that they have experienced a steadily increasing demand for their lamps during the past year, and will now be obliged to enlarge and alter their factory during August. They therefore ask that any orders may be sent to them as early as possible. It will be a convenience and will ensure prompt shipment during the next sixty days.

NEW YORK NOTES

AMERICAN IMPULSE WHEEL COMPANY, of 120 Liberty street, New York, have secured the contract for furnishing water wheels for the lighting station for the city of Columbus, O.

PITT & SCOTT, the well-known foreign freight brokers and express carriers, of 39 Broadway, have just issued the eleventh edition of their admirable little book of "Useful Notes," intended for travelers in Europe. It is full of information and serves as a vest pocket Murray or Baedeker.

BURGER & ADAMS. Mr. Clarence Livingston Burger, the patent attorney and expert, has associated with him in the practice of patent and trade-mark law Mr. Louis B. Adams, under the above firm name. The offices of the firm remain in the Postal Telegraph Building, 253 Broadway, where Mr. Adams continues also the practice of the law.

MR. S. GLOVER WAY, of late with the General Incandescent Arc Light Company, has just entered the employ of Messrs. Osterberg & Sutton, consulting engineers, as their superintendent of construction.

McINTOSH, SEYMOUR & Co. have booked orders for two 700 h. p. horizontal cross compound engines to be used in the City of Mexico. They will be directly connected with two 452 k. w. General Electric generators, for trolley work. A 150 h. p. engine has also just been sold by this concern to the Kimberley mines of South Africa. This engine will be directly connected to two 50 k. w. generators of the double-end plan.

CONTENTS.

EDITORIALS:
Electric Power in Rolling Mills ... 58
Street Railway Travel ... 58
Railway Motor Control ... 58
Light Without Heat ... 59
Building a Pacific Cable ... 59
Independent Telephony in Indiana ... 59

POWER TRANSMISSION:
A Fourteen-Mile Transmission at Barton, Vt., with Monocyclic Apparatus (illustr.) ... 49

ELECTRIC LIGHTING:
The Glasgow, Scotland, Municipal Lighting Plant, Port Dundas (illustr.) ... 51
Two-Wire Distributing Systems and Lamps, 200-240 Volts ... John W. Howell. 52
The Hull Alternating Arc Light Regulator (illustr.) ... 53

ELECTRIC TRANSPORTATION:
Storage Battery Plant of the Buffalo Street Railway (illustr.) ... Orrin E. Dunlap. 53
Notes from the Field: Electricity on the Pittsburg Street Railways.—I. ... C. B. Fairchild. 54
The Henry "Regenerative" Controller for Electric Cars ... John C. Henry. 56

MUNICIPAL AFFAIRS:
Newark, O., City Plant Mismanaged ... 57

PERSONAL:
Lieut. S. D. Greene.—Mr. Luther Stieringer.—Prof. Slaby ... 57

LETTERS TO THE EDITOR:
How Best to Secure Exact X-ray Indications ... W. J. Clarke. 59

TELEPHONY AND TELEGRAPHY:
Citizen and Bell.—Recent Marconi Wireless Telegraphy in England.—Telephony in Russia.—Telephony Between St. Petersburg and Moscow.—Government Cable to Block Island.—The Arc as a Telephone.—Sender Must Stamp Telegrams ... 60
Another Big African Telegraph Scheme ... 61

MISCELLANEOUS:
Alternating Current Transformers, from the Station Manager's Viewpoint.—II. (concluded) ... W. F. White. 61
Dielectric Strength of Air ... C. P. Steinmetz. 62
Lightning Arresters (illustr.) ... A. L. Wurts. 64

EDUCATIONAL:
University of Tennessee Record.—Purdue University.—Michigan Engineers' Manual.—University of Minnesota.—Lehigh University.—Cornell University, Physical Review ... 65

NEWS AND NOTES:
Photograph of the Holy Shroud by Electric Light.—Glass as a Conductor ... 65
Testing Gold Quartz by the Röntgen Rays.—Nerve Currents.—Telephones and Liquid Air ... 66

OBITUARY:
Dr. Cornelius Herz ... 66

LEGAL NOTES:
Railway Motor Suspension.—Western Electric Co. vs. Am. Rheostat Co.: Motor Cut-Out ... 66

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents Issued July 12, 1898 ... 67

THE STOCK MARKET:
Favorable Conditions ... 67

REPORTS OF COMPANIES:
Sale of Brooklyn Edison Co. to Kings County Co ... 67

TRADE NOTES AND NOVELTIES:
The Commercial Electric Co.'s Iron Clad Motor (illustr.).—Raritan Copper Works, Perth Amboy, N. J.—The Solar Carbon and Manufacturing Company, Pittsburg ... 68
Repairing a Railway Generator Armature, Cleveland, O. (illustr.).—The "Monarc" Enclosed Arc Lamp (illustr.).—Improved Holtzer-Cabot Automatic Burner (illustr.).—Extensive Additions to Walker Company's Plant ... 69
G. E. Compensator for Series Incandescents (illustr.).—Kent Battery Fan Motor (illustr.).—Manufacturers' Building, Providence.—Pelton Water Wheels ... 70
Campbell & Zell Company, Baltimore.—Ohio Electrical Specialty Co.—Stone & Webster.—The Electric Storage Battery Co.—Ball Automatic Cut-Off Engines.—Edison Mfg. Co. ... 71
Advertisers' Hints.—New York Notes.—Western Notes ... 72

Department News Items will be found in advertising pages.

Digitized by Google

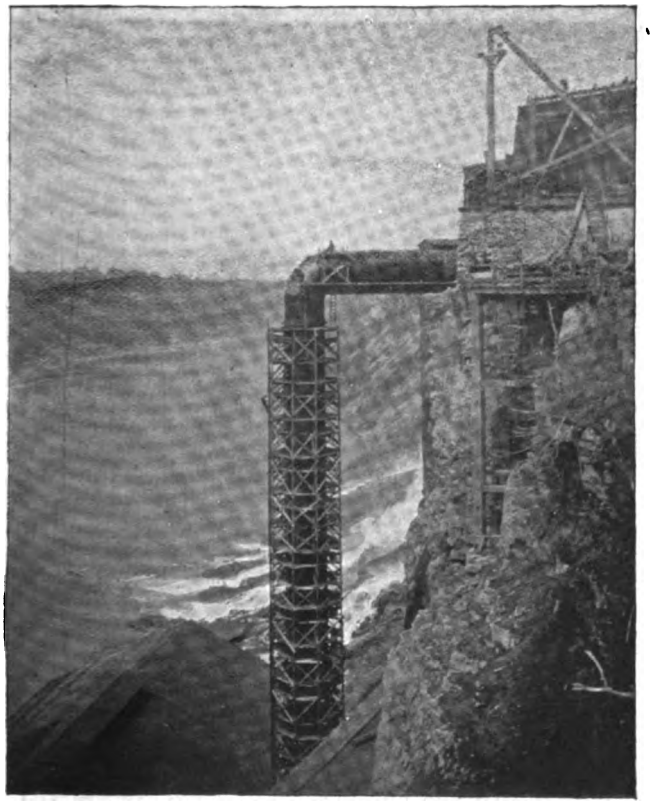
The Electrical Engineer.

Vol. XXVI. JULY 28, 1898. No. 534.

New Work at Niagara Falls by the Hydraulic Company.

BY ORRIN E. DUNLAP.

THE Niagara Falls Hydraulic Power & Manufacturing Company have just placed in operation the first turbine and generator located in the extension of their power house in the gorge. This extension of the company's plant has been in progress for some months. The addition made to the building is 60 feet long by 100 feet wide, and the total dimensions of the power house to-day are 120 by 100 feet. The addition is of the same style of architecture as the original section of the building, and has been built on the south end. The partition between the two sections has been removed, throwing the entire floor into one. Many readers of The Electrical Engineer have visited the Falls and personally inspected the installation in the first section of the power house, and will remember that it consists of four turbines made by James Leffel & Company, of Springfield, O., which operate eight generators. The new turbine and generator just installed stand out further toward the west wall of the building than any of the machines first installed. A gallery-like structure has been built close to the cliff wall and on it the switchboards of the old and new installations are located. This is quite a noticeable improvement, and was made under the supervision of Frank G. Lott, the company's chief electrician and superintendent.

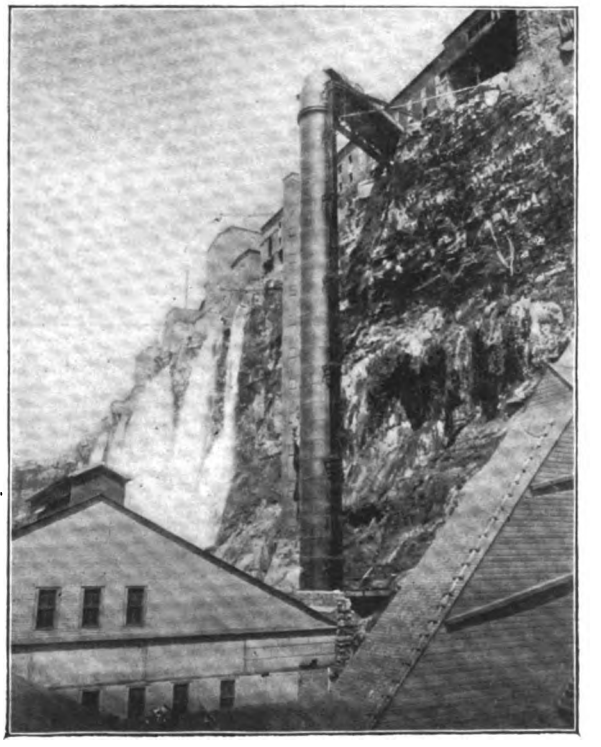


PENSTOCK OF NEW INSTALLATION OF N. F. H., P. & MFG. CO.

The property of the power company presents a scene of activity at all points. On the canal men are busy with the work of enlargement, and over the new forebay a steel gate house has been erected. Out from beneath this extend the walls of the new connecting canal running from the main canal basin to the forebay. The walls of this canal are built of concrete, and are most substantial in appearance. It will be remembered that in building the forebay extension a large amount of concrete was used, the company finding it most serviceable for this class of construction. As the connecting canal passes under the New York Central Railroad tracks it is made water tight beneath the roadbed in order that high water will do no damage.

The penstock that will supply the new wheels with water is larger than the one that supplies the wheels in the original section. It is about 11 feet in diameter and leaves the forebay in an elliptical bell mouth about 20 by 11 feet. For 60 feet it extends out horizontally, and then vertically about 200 feet to the power house. It stands out from the cliff in column form, and attracts immediate attention. As it passes beneath the power house floor the diameter increases to about 13 feet for a distance of 50 feet, and then reduces until it is about 7 feet, finally tapering in a cone 18 inches in diameter and ending in an air chamber 15 feet high and 4 feet in diameter. Along its course under the floor there are five 60-inch valves for supplying the wheels. The thickness of the steel in the penstock varies from $^5/_{16}$ to $1\frac{1}{8}$ inches. It was made by Struthers, Wells & Co., of Warren, Pa.

The number of wheels to be installed is five, the first of which has been built and installed by R. D. Wood & Co., of Philadelphia. Its capacity is 2,500 horse power, and it has been placed over the last of the five valves on the penstock. The general appearance of the wheel is very similar to that of the wheels installed in the original section of the station, but its construction varies somewhat. Generally speaking, the wheel may be said to be the same as those used by the Niagara Falls Paper Company, there being but a slight difference between them, which is to be found in the curve of the buckets, a difference made necessary by the fact that the head of water at the paper mill is about 140 feet, while in the station under discussion the head will be about 210 feet. This wheel is known

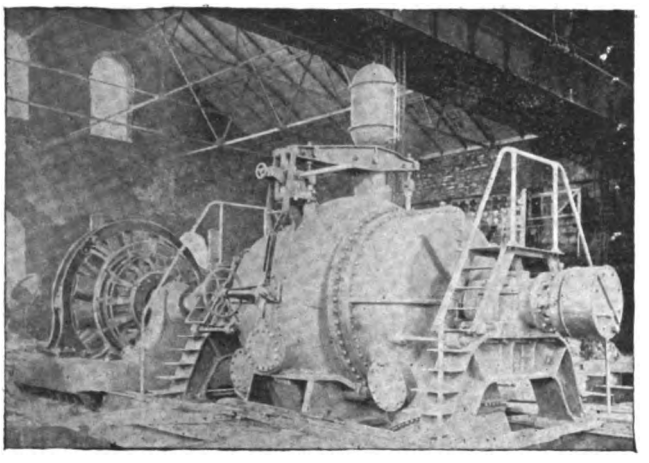


ALUMINUM CABLES RUNNING ALONG PENSTOCK OF NEW INSTALLATION OF N. F. H., P. & MFG. CO.

Digitized by Google

as the Jonval-Geyelin improved. It consists of a large, vertical circular casing in which the wheels proper are located, for there are two wheels within the case. The water is admitted underneath and flows upward, being admitted to the guide wheels by a gate and then to the runners. The discharge pipes project from the sides of the casing laterally and downwardly, draft tubes 22 feet 8 inches long being attached, thus utilizing, in part, the atmospheric pressure. The heads of the large casings are more oval and not quite so high as the casings about the wheels in the original section of the building. The heads are made of cast iron 1¾ inches thick and have heavy 2½ by 6 inch ribs at the bottom. The casing weighs about 10 tons, while the total weight of the wheel installed is about 21 tons. It rests upon a pair of 24-inch steel I beams. The wheels are made of bronze and are located in draft tubes, one on each side of the casing proper, upon a horizontal shaft. This shaft is supported by a rigid bearing with the flush bearings bolted to rigid bearings. The disc that forms part of the flush bearings is keyed to the shaft and adjusted by four heavy set screws, one on each side of the shaft, to take up the thrust. The wheels discharge laterally into the discharge or receiving pipes. Four 2¾ rods extend through the casing to stiffen it. The two wheels weigh 5,095 pounds. In designing this turbine, special care was taken owing to the great pressure on the component parts, and especially on the gates, which are planned on a slide motion principle and are counterbalanced, a simple but effective method of overcoming the enormous pressure which would act on each individual turbine gate.

The gate used is a ring gate, which revolves on a barrel. This



NEW TURBINE AND GENERATOR IN STATION OF N. F. H., P. & MFG. CO.

is fastened to the guide wheels by bolts, and the gate is operated by a walking beam, which works over the top of the case proper. The gate is connected to the beam by steel gate rods 2½ inches in diameter, which extend down through glands into the casing. Cast steel brackets are riveted to the gate and to these the gate rods are connected. The runner has 34 buckets with a total area of 140.25 square inches. The guide wheel has 20 buckets having a total area of 149.53 square inches. Over the walking beam there rises an air cylinder which is about 36 inches high, and has an inside diameter of 20½ inches. It is understood the Reynolds governor will be used on the wheel. Provision has been made for disconnecting the governor by simply operating a wheel which unscrews a rack. E. H. Broome, one of R. D. Wood & Co.'s most efficient engineers, was in charge of the work of installing the wheel, Mr. Broome being the Niagara Falls representative of the company.

It is intended that this wheel shall operate two generators. One of these machines already furnishes current for the operation of the National Electrolytic Company, while the other will add to the supply of the Buffalo and Niagara Falls Electric Light and Power Company. The generator for the service of the first named company has been installed by the General Electric Company. This machine has 14 poles and will make 250 revolutions per minute. Its output will be 5,000 amperes at 175 volts, or a capacity of 875 kilowatts, nearly 1,200 horse power. It is of a large type and direct connected to the water wheel shaft on the left. The factory that will use the current from this machine is located on the high bank above. Aluminum will be used as the conductor between the generator and the plant. The lower portion is erected in the form of bars, and the upper portion in the form of insulated cables. This style of conductor is the first of its kind put in use. The aluminum cables of the original installation have given entire satisfaction, a fact which has led to the still further adoption of the white, light metal.

The Buffalo and Niagara Falls Electric Light and Power Company take a portion of their current supply from the Niagara Falls Power Company and a portion from the Niagara Falls Hydraulic Power and Manufacturing Company. Their main station is located near 14th street, opposite the central station of the Niagara Falls Power Company, but they have a very efficient installation in the basement of the Cliff Paper Company's mill, and it is this installation that the new generator and connection will do away with. The generator is now being made by the Walker Company, of Cleveland, O. It will be an alternating current dynamo of 700 kilowatts capacity at 2,200 volts pressure, to be operated at 250 revolutions per minute and at 125 cycles per second. A continuous current exciter of sufficient capacity to supply current to the fields of the above mentioned dynamo to permit of its producing 1,100 kilowatts at its standard voltage, should such be required for a short time, will also be installed. The switchboard for this machine will be of blue Vermont marble and will be mounted with all the necessary instruments and appliances.

It is a very noticeable fact that both of the large power companies at Niagara stand ready to adopt everything they feel will make an improvement in their installations. For this reason the new installation of the Niagara Falls Hydraulic Power and Manufacturing Company shows several changes over the original plant. Chief among these is the series of iron posts and beams placed in the tail race beneath the power house floor to support the penstock and wheels. All parts of this work have been made adjustable by a series of keys, the work having been done by the Variety Iron Works of Cleveland, O. The new tail race is a little larger than the old one, and is most substantially built.

All the work of the Niagara Falls Hydraulic Power & Manufacturing Company is done under the supervision of Wallace C. Johnson, M. Am. Soc. C. E., who is president of the Engineers' Society of Western New York. Mr. Johnson is especially pleased with the new installation, and feels that future visitors to the plant will admire its many merits. In this connection it may be stated that Mr. Johnson has become known as an engineer of high authority on power development, and has been consulted in regard to many very promising projects in which capital has invested or is about to invest.

A few words must be added with special details of the aluminum conductors. From the power house to the top of the bank these conductors are in bar form. The bars are 25 feet long, ½ by 6 inches in thickness and width, and four are placed in parallel. The bars are riveted and bolted every 25 feet, and they extend from the power house to the top of the bank along the side of the big new penstock, the erection being on brackets. At the top of the bank they are connected to the aluminum cables, twelve of which are on each leg. In diameter the aluminum part of the cables is about 1¼ inches, covered with rubber insulation. The size of the wire in the cables is about No. 10. The bars are connected to the cables by castings, which contain sockets, just holding the ends of the cables. These ends are placed in the sockets and melted tin is poured about them, making a solid permanent joint. The total amount of aluminum used in the installation is about 22,000 pounds. The same work in copper would call for about 48,000 pounds. The conductivity of aluminum as compared with copper in same section is 63 to 64 per cent., and more than double for the same weight. One important feature demonstrated in the erection of the new aluminum conductors at Niagara was the ease with which they were placed in position, as compared with the work of erecting copper cables. The high cliffs along the Niagara gorge, at the point of the installation do not offer many advantages for easy placing of materials, but the aluminum conductors, owing to their lightness of weight, were easily handled, and erected with rapidity. While it is a fact that aluminum cables require more insulation than copper, it seems very likely that there is a field for the use of aluminum in feeder cables. There is little doubt but that the extra cost of

Digitized by Google

the insulation would be met by the manufacturers in the price of the metal, especially on large orders. The lightness of the aluminum cable, also its strength, would make it possible to use the aluminum conductor in much longer spans, thus doing away with the cost of the extra poles and insulators now required by copper, which in miles of line is no small factor.

The aluminum conductors referred to are the second set installed by the Niagara Falls Hydraulic Power & Manufacturing Company, thus attesting their confidence in the metal. The first set of aluminum conductors placed by them runs from the original installation in their station to the lower works of the Pittsburg Reduction Company. These conductors are in the form of huge cables, two in number, with 250 strands in each, insulated. The new conductors are neater in appearance and extend to the top of the bank outside of the penstock, while the large cables referred to run up the cliff through a tower.

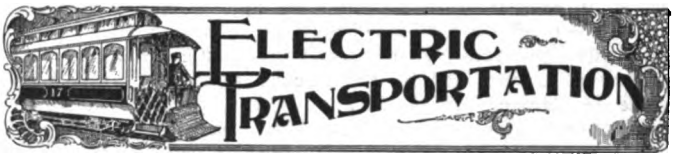
The Welland Power Canal.

THE Welland Power & Canal Supply Company still have hopes that they will be able to carry their project through. This company holds a franchise for the construction of a power canal from the Welland River to the brow of the mountain at Thorold, Ont., a distance of about eight miles. From the mountain they would carry the water to Lake Ontario by means of a raceway, possibly using the water at another level. Henry Symons has just returned from England, where he went to see what could be done with the project and to secure estimates on its probable cost. It cannot be said, however, that the figures are altogether encouraging. Mr. Symons, realizing that a market for the power might be an incentive to capital to invest, secured estimates also on the construction of a transmission line from Thorold to Toronto by way of Burlington Beach. The estimates Mr. Symons has given out were prepared by Dr. John Hopkinson, F. R. S.; Edmund Wragge, formerly of Toronto; Sir Douglas Fox and Prof. W. Cawthorne Unwin. Prof. Unwin's name in connection with the estimates excites interest in this country because he is known to have had prominent connection with the great development at Niagara Falls, having been a member of the International Niagara Commission organized by the Niagara Falls Power Company to solve the problem of the then prospective Niagara development. In the estimates given it is stated that the machinery to generate 100,000 horse power will cost £125,000; the excavation and other work connected with the project, £1,525,062; the transmission line to Toronto, at a voltage of 10,000 and delivery of 50,000 horse power, £801,600, making a total of £2,542,162, which is in the neighborhood of $12,000,000. If the amount to be delivered in Toronto is reduced to 20,000 horse power, it would cost $1,000,000 less. Naturally, long term contracts with Hamilton and Toronto for power would aid the company's ideas.

The Abuse of the Power Station.

Mr. W. H. Preece read a paper before the Incorporated Association of Municipal and County Engineers at Yarmouth, in which he calls attention to the abuse of the power station. He says the great tendency to multiply power houses arises from (1) want of foresight in predicting the growth of electric industries; (2) economy in selecting land we have, rather than pay money for land more suitable by position, but which we have not; (3) the restriction of legislation in confining operations to a defined area; (4) the growth of other industries side by side, especially tramways and railways worked by electric traction. He also points out that if a plant—say 10,000 k. w.—working at its minimum load on the average three hours a day produces electrical energy at one penny (2 cents) a unit, it will do so at three farthings (1½ cents) per unit if it works six hours a day, one halfpenny (1 cent) per unit if it works twelve hours a day, and less than a farthing (½ cent) per unit if it works twenty-four hours a day. One large station conveniently built on the waterside where coal can be delivered alongside, by rail or sea, at its cheapest; where water is abundant and available for condensing, where ashes, clinkers and dirt are easily barged away, is clearly the ideal power house for economy.

MASS. CHAR. MECH. ASSOCIATION announces that the General Electric Company will make a working exhibit at the twentieth triennial exhibition to be held in Boston in October.



Combined Trolley and Accumulator Traction System in Paris.

AN interesting application of electric traction has just been carried out in Paris by the French Thomson-Houston Co. on the tramway lines of the Place de la République d'Aubervilliers and to Pantin. Within the limits of the city of Paris the roads are operated by accumulators, and beyond the limits by means of overhead trolley. The two lines about to be described have in Paris a total length respectively of 3¾ miles and 4.2 miles, with a common track of 1½ miles. Beyond the

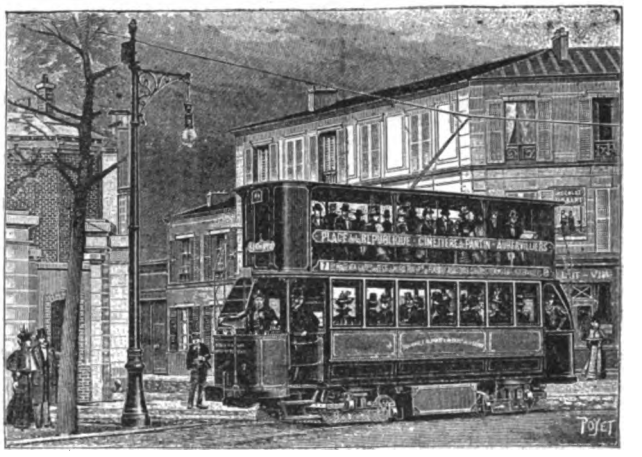


FIG. 1.—COMBINATION BATTERY AND TROLLEY CAR, PARIS.

city limits the two lines are 1 mile and 1⅓ miles in length, respectively. There are also three other lines which run into other villages at the gates of Paris.

The roadbed has been installed by the Paris Tramway Co. and by the Department of the Seine. The rails are of the Broca section, about 90 lbs. to the yard for the middle of the road, with rails of the Vignole section when they run side by side. The cars employed, shown in Fig. 1, have double decks and carry 56 passengers; that is to say, 4 on the platform, 24 inside below, and 28 on the upper deck. They may be criticized as being too large; it would be preferable to assure good service to have the cars smaller and have them run oftener. Aside from this, however, the cars are very well designed.

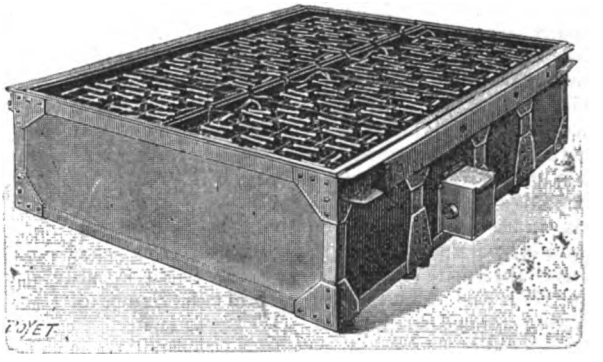


FIG. 2.—STORAGE BATTERY USED ON COMBINATION TROLLEY AND BATTERY CARS, PARIS.

They rest on bogie trucks, which permit of utilizing the traction of both motor trucks.

The cars are the same at each end, so that they can be run in either direction without turning at the terminal points. Each truck is operated by an electric motor of 25 h. p. and controllers are placed on each platform. Each car is provided with sand boxes, with ordinary brakes and with electro-magnetic

Digitized by Google

brakes on each truck. The latter are able to stop within less than 43 feet, with a car loaded with 4.4 tons on a down grade of 2.4 per cent. running at a speed of 12 miles an hour. The cells, Fig. 2, furnished by the Société pour le Travail Electrique des Metaux are 224 in number, of 7 plates each, with a capacity of 35 ampere hours. The plates have a height of 12¼ inches and are 0.36 inches thick, enclosed in ebonite boxes. The box which holds the batteries, and which is placed under the car, as shown in Fig. 3, is 6 ft. 6 in. long, and 8 feet wide and ½ ft. high. The electric equipment of each car is such that the motors can be operated either from the battery or from the trolley current, which also at the same time charges the storage batteries. Each car is lighted by 10 incandescent lamps of 16 c. p. each.

The power house is situated at d'Aubervilliers, and is divided into two principal parts. On one side is the boiler room, the engine room and the repair shop for the accumulators. On the other side are the tracks for the storage of cars, with arrangements for complete inspection.

The boiler house contains three multitubular Roser boilers.

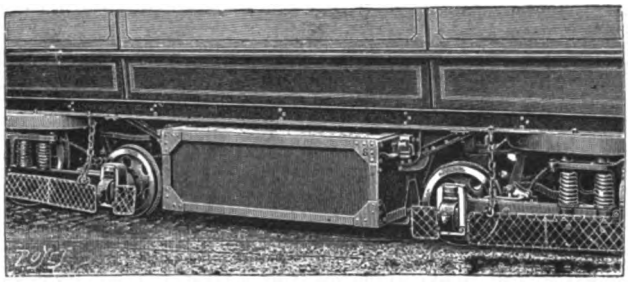


FIG. 3.—BATTERY IN PLACE ON COMBINATION TROLLEY AND BATTERY CARS, PARIS.

In the engine room are three single cylinder, horizontal Corliss engines built by Garnier, of 250 h. p. each, running at 75 revolutions per minute. Each engine drives a Thomson-Houston compound 6-pole dynamo of 150 k. w., generating 550 volts at 400 revolutions per minute. These machines are built by the firm of Postel-Vinay. The same machines can be driven as shunt dynamos of 575 volts for charging accumulators. Two main circuits are taken from the switchboard, one at 530 volts for feeding the trolley lines, the other at 575 volts for charging accumulators while en route. The four feeders can be branched as desired either on one circuit or the other.

Such are the main arrangements as described by Mr. J. Laffargue in "La Nature" of the new mixed accumulator and trolley system which seems to answer perfectly to the present requirements of traction in Paris.

Buffalo-Niagara Trolleys.

The Buffalo, Tonawanda & Niagara Falls Electric Railroad Company, on Saturday, July 16, opened for traffic a new extension of their lines. This new line begins at the corner of Tonawanda and O'Neil streets, on the northerly limits of the city of Buffalo, and follows O'Neil street to Niagara street, thence along Niagara street about one mile to a ferry on Niagara River, which runs between the terminal of this new extension and various resorts on Grand Island. This line will be further extended along Niagara street to the village of Tonawanda, and will prove to be a popular electric line between Buffalo and Niagara Falls, as it follows the high banks of the Niagara River the entire distance in full view of the beautiful scenery of that river and Grand Island. Henry B. Smith, of Bay City, Mich., is principal stockholder.

A Decision for Electric Cabs in Paris.

The Compagnie Generale des Petites Voitures in Paris has now definitely given the preference to electrical cabs over those using petroleum as a motive power. The latter are held to have a disagreeable odor and are less manageable than the electric.

DETROIT, MICH., has been agitating and petitioning for the handling of light freight on the city street railways.

Notes From the Field—Electricity on the Pittsburg Street Railways.—II.

BY C. B. FAIRCHILD.
UNITED TRACTION COMPANY.

THE mileage of this system is located on both sides of the Allegheny River, covering portions of Pittsburg and of Allegheny. The power is concentrated in two stations, one in Pittsburg, on Second avenue, the other in Manchester. The latter station has recently been enlarged and re-equipped with new engines, generators and boilers. The addition to the building consists of a brick extension running the whole length of the building, parallel to the engine room, and which constitutes the new boiler room. In the original equipment the boilers were located at the end, instead of at the side of the boiler room. By the new arrangement, the relative distance between boilers and engines has been maintained, and both can be extended uniformly when necessary. The ground dimensions of the building are 135x157 feet, the engine room being 75 ft. in width. The new equipment, which entirely replaces the old, consists of four direct coupled tandem compound condensing Green engines, having cylinders of 20-38x48 inches, and nominally rated at 800 h. p., but can be run up to a maximum of 1,200 h. p. each. The generators, which are of Westinghouse manufacture, are each of 500 k. w. capacity, with special wiring to secure ventilation, and are guaranteed to stand 25 per cent. overload for eighteen hours, without increasing the temperature above 40 degrees. The shells of the main bearings on the engine bed are all cast hollow for water jacketing, should it become necessary to employ water for cooling the boxes. Another feature consists in so leading the oil to the cylinder that it falls directly on to the valves, securing better lubrication than when introduced into the steam pipe. The steam pipes are arched and lead directly from the steam drums over and down to the cylinder, avoiding angles and joints. The steam generating equipment consists of eight 400 h. p. water tube boilers, of the Sterling type, which are fired by Murphy stokers, the coal being fed by gravity from self-measuring and recording hoppers, located above the furnaces. The cars for delivering coal run into the boiler room on an elevated track and discharge their coal into a storage vault beneath the floor, which runs the whole length of the boiler room, the retaining walls being of stone. From the vault it is elevated to the hoppers by means of a traveling elevator operated by an electric motor, which is mounted upon a platform on the elevator itself. This elevator or conveyor runs upon a track which is located near the bottom of the pit, and also upon a track at the top. The motor furnishes power both for driving the bucket and for moving the elevator along the track, the latter movement being effected by throwing a clutch that connects the wheels at the base with the motor. In operation the elevator is brought opposite one of the delivery spouts in the bin, from which when the gate is open the coal runs directly into the buckets of the elevator, and is raised to the hoppers and delivered by gravity, as required, to the stokers through the self-registering and self-weighing chutes.

The elevator was erected by Heyl & Patterson, of Pittsburg. The same conveyor removes the ashes from beneath the fire boxes, and elevates and discharges them into cars or carts for removal. The auxiliary steam equipment includes condensers built by Dunn & Dorton, of Cincinnati. The condensing water is drawn through a 20-inch main, from a cement lined cistern, located along the outside wall of the engine room. This cistern is 100 ft. in length, and has a cross section of 10x8 feet, and is filled by pumps located in a well 17 ft. below the coping. This well is 60 ft. deep, and 12 ft. 6 in. in diameter, and communicates with a brick tunnel 4 ft. 6 in. in diameter, and 60 ft. in length, which extends under the bed of the river to the edge of the channel, and which terminates in a filtering crib. The condensers are protected from high water by cement walls, although it is high enough sometimes to flow directly into the cistern. Filtered water from the condensers is used for feed water, although water from the city mains can be employed. The switchboard is of Italian marble, and is 45½ ft. in length, with panels for six generators and 20 feeders. The board is designed for a three wire system, although the road at present is not operated with three wires. The three bus-bars are made up of copper plates ⅛-inch in thickness, and 3 inches wide, and each one contains sufficient copper to run the whole road, if necessary. The board is equipped with West-

Digitized by Google

inghouse instruments with the lighting switch independent of the circuit, so that it does not leave the station in darkness when the circuit breakers are opened. A special six-pole switch is provided for the lighting circuit, which connects with each machine. This is placed at the middle and near the base of the board. Two cables from each terminal of 650,000 c. m. capacity each lead down under the floor to the switchboard, from which the feeders go out over poles for distribution.

One of the features connected with the operating department worthy of note is a wheel grinding machine, which was designed by the general manager, and which will grind the wheels without removing them from the car. The car being jacked up, the wheels revolve by their own motor, while emery wheels driven by stationary motors are revolved against them or in contact with them in the opposite direction. With this equipment the cost of grinding wheels is estimated to be from 50c. to 60c., as against a cost of from $3 to $7 where whe ls have to be removed for grinding. Electric transfer tables are employed in the repair shops, which are equipped with discarded car motors, and which take the current from an underground trolley. The standard type of motors employed on the cars of this company are the Westinghouse No. 38, and the trucks are nearly all of the Lord Baltimore type. Three cars on the system are equipped with the Clark hydraulic brake. There are also five equipments of Walker No. 50 motors. One double truck car having four motors, has recently been equipped with the new Walker type S. controller. This controller is provided with solenoid blow-outs, and is working very satisfactorily. The president of the United Traction Co. is James D. Callery, and the General Superintendent is John Murphy.

Some Phases of the Rapid Transit Problem.[1]

BY ALBERT H. ARMSTRONG.

As running at a constant speed does not occur in rapid transit service where stops are at all frequent, it becomes of the greatest importance to carefully investigate the subject of train acceleration in order to determine the method of running a train from station to station with the least expenditure of energy.

Problems in train acceleration may be divided into two broad classes: 1. Where the road is level; and 2. Where grades exist or where an artificial profile is made in order to take advantage of down grades at starting.

Modern passenger cars demand a dead weight of approximately 550 pounds for each passenger carried, or, in other words, only 20 per cent. of the total weight of a loaded motor car is a paying load. When it is considered that in rapid transit service with frequent stops, over 80 per cent. of the total energy output of the motive power on level roads is required to accelerate the train, it is evident that in this class of service the rolling stock requires the greatest attention.

To avoid undue complication, the following discussion has assumed that train friction is a constant quantity at all speeds, as at the low maximum speeds—20 to 30 miles per hour—reached in practice with frequent stops of two or more per mile, the error introduced by assuming a constant friction rate will be small and will not at all alter the conclusions arrived at.

The following constants have been assumed as representing average operating conditions: Length of run, 2,000 feet. Length of time train is in motion, 75 seconds. Schedule speed, 16.05 miles per hour, including 10-second stops, or 85 seconds total time. Tractive effort, 100 pounds per ton total, to be maintained uniform during acceleration of the train. Braking effort, 150 pounds per ton constant throughout the period of braking. The train friction being 15 pounds per ton, reduces the effective accelerating force from 100 to 85 pounds per ton, corresponding to a rate of .927 miles per hour per second.

With this data a simple acceleration curve may be calculated, the train reaching a maximum speed of 28 miles per hour in 30 seconds, when power is shut off and the train allowed to coast with a retardation due to friction of .1635 miles per hour per second for 31 seconds to the braking line, when it is retarded at a uniform rate of 1.635 miles per hour per second and comes to rest in 75 seconds from time of starting.

It is obvious that the train could be accelerated at a different rate than that corresponding to 70 pounds per ton and still make the same length of run in the same time, the length of time occupied in coasting depending upon the rate of acceleration, being a maximum with an infinite rate, that is, with the train starting with a certain initial velocity. A minimum rate of acceleration is reached when no time is left for coasting, that is, when brakes are applied as soon as power is shut off. In Fig. 1 such a set of curves has been prepared showing a train covering a distance of 2,000 feet in 75 seconds, as before, but accelerating at various rates from that corresponding to 62.8 pounds per ton as a minimum up to an infinite rate, or starting with an initial velocity of 25.2 miles per hour.

As the area enclosed by time as abscissæ and speed as ordinates represents the distance covered, this will be a constant quantity for the fixed distance of 2,000 feet assumed, and curves of Fig. 2 are thus constructed with the same enclosed area for each rate of acceleration. The fact is plainly brought out that with a low rate of acceleration a much higher maximum speed is demanded than would be the case if the rate had been increased, and a curve may be plotted by joining the maximum speeds reached for different accelerating rates, as shown.

It is advisable in rapid transit service to keep the maximum

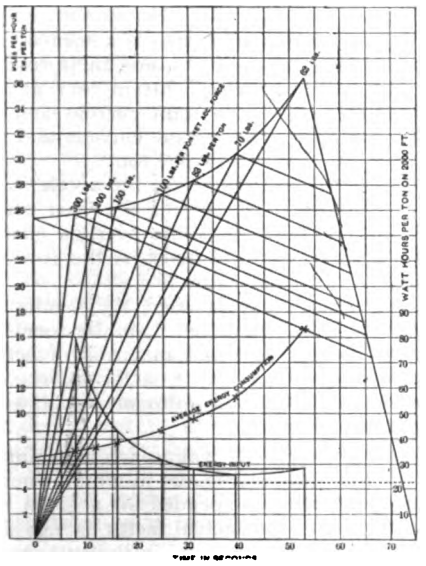


FIG. 1.—SPEED AND ENERGY CURVES. (Distance, 2,000 feet. Time, 75 seconds. Friction, 15 lbs. per ton. Braking Effort, 150 lbs. per ton.)

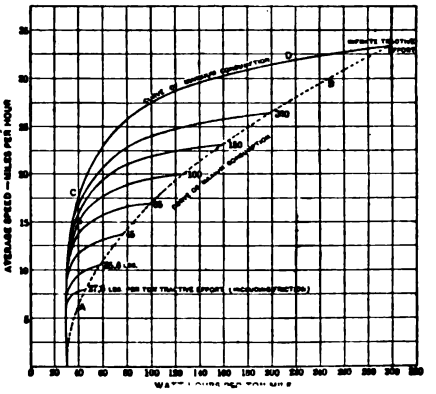


FIG. 2.—SPEED AND ENERGY CURVES. (Distance, 2,000 feet. Friction, 15 lbs. per ton.)

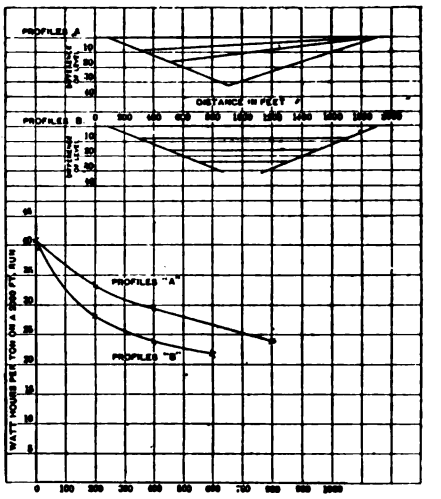


FIG. 3.—ENERGY CURVES ON ARTIFICIAL PROFILE. (Distance, 2,000 feet. Time, 75 Seconds. Starting Grade of 4 per cent. Tractive Effort of Motors, 100 lbs. per ton. Friction, 15 lbs. per ton. Braking Effort, 150 lbs. per ton.)

[1]Abstract of a paper read at the 15th General Meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

speed reached by the trains as low as possible, as this class of work generally calls for a short time interval between trains where the utmost precautions are necessary to keep the trains a safe distance apart. In fact, the maximum speed required for a given run practically determines the time interval between trains, as the train headway should be at least five or six times the length of time required to bring a train to rest from its maximum speed with normal braking force applied.

A second reason for higher rates of acceleration lies in the fact that with rates of acceleration approaching the minimum no margin is left for errors of judgment of the motorman, as little or no time is left for coasting, and the rate of acceleration per ampere input is continually varying with the changing passenger load and hence with an overload it becomes difficult to maintain schedule speed. A third and most important objection to the use of a low rate of acceleration lies in the saving of energy for the run by the use of a higher rate.

Neglecting $I^2 R$ and core losses of the motors, a set of energy input curves per ton weight of train may be plotted as in Fig. 1, assuming for simplicity that motors are series wound, operate all in multiple and are so geared that starting resistance is entirely cut out at the various maximum speeds reached in the various runs, that is, that no accelerating is done on the motor curve. A constant impressed e. m. f. is assumed, and starting resistance is supposed to be cut out proportional to the motor speed, thereby keeping the current and torque constant.

Thus it is seen that accelerating a train with the minimum rate calls for the highest maximum speed, demands nearly the least current input and also demands the greatest waste of energy in the brakes, as the speed is a maximum when brakes are applied.

The areas enclosed by the various energy time curves represent the comparative amounts of energy required for the run for the different rates of acceleration and these are plotted in Fig. 1, which compares the energy input and the average energy consumption for the run of 2,000 feet in 75 seconds for all rates of acceleration from the minimum corresponding to 62.8 pounds per ton up to infinity.

For convenience the average energy rates are plotted in terms of watt hours, and the curve shows that while the minimum rate of acceleration corresponding to 62.8 pounds per ton calls for an expenditure of 83.5 watt hours per ton weight of train, this is reduced to 56.5 watt hours by accelerating with a rate corresponding to 70 pounds per ton, to 42.7 watt hours with 100 pounds, and finally reaches a minimum value of 32.5 watt hours if the accelerating rate is pushed to infinity.

Thus the energy required for the run of 2,000 feet in 75 seconds may vary from 83.5 to 32.5 watt hours per ton of train weight, a decrease of over 60 per cent., depending upon the rate of acceleration used.

The error made in accelerating at or near the minimum rate is clearly brought out. For example, the current consumption per ton is the same for 62.8 pounds per ton or 85 pounds per ton; as, although 85 pounds calls for the greater tractive effort, the torque per ampere is so increased by the lesser maximum speed demanded that the current input is the same in each case, hence the feeder considerations are the same in both cases, while the energy consumption shows a reduction from 83.5 watt hours per ton with 62.8 pounds to 47.5 watt hours, or about half, with 85 pounds per ton.

Referring again to Fig. 1, it is obvious that a similar set of curves may be plotted for a run of 2,000 feet for any other length of time than 75 seconds, and the author gives such a set of curves plotted for lengths of time ranging from 41 seconds, as a minimum possible, up to 210 seconds.

To compare the amounts of energy required for rates of acceleration other than the maximum and minimum, a set of curves has been prepared in Fig. 2 giving the energy consumption for a run of 2,000 feet on a level track for any rate of acceleration and for any length of running time, the constants being 15 pounds per ton friction rate and 150 pounds per ton braking effort. For convenience in comparison, the energy consumption is reduced to watt hours per ton mile, and speed is expressed as average speed in miles per hour while train is in motion or equaling schedule speed if the train loses no time in stopping. The dotted curve a b is the maximum energy curve and the curve c d represents the minimum amount of energy possible for the different speeds and is described by an infinite rate of acceleration.

The curves of maximum and minimum energy consumption approach each other and coincide at a speed of 33.3 miles per hour, corresponding to an energy consumption of 298 watt hours per ton mile, this value being the greatest amount of energy that can be expended on the run with 150 pounds per ton braking effort.

All energy values are net, that is, they represent the amount of energy required to accelerate the train plus energy lost in overcoming friction, and hence take no account of any losses occuring in actual operation in the motors, rheostats, gearing, etc.

Fig. 2 shows the economy resulting from properly proportioning the accelerating rate to the schedule speed and distance traveled. For example, a train accelerating with a tractive effort of 100 pounds per ton and making 20 miles per hour average speed, not including stops, will require 127 watt hours per ton mile, which would be reduced to 65 watt hours per ton mile if the tractive effort had been increased to 150 pounds per ton, or, in other words, the generator capacity would be but half as large for the same service.

The curve of 300 pounds per ton tractive effort is interesting as it represents about the maximum speed attainable with modern apparatus for a distance of 2,000 feet with the assumed constants of friction and braking effort. Assuming the entire weight of the car to rest upon drivers, about 300 pounds per ton would be available for traction without slipping the wheels on an average track, so that an average speed of 26½ miles per hour is the highest that could be obtained over a distance of 2,000 feet, not allowing any time whatever for coasting.

All previous curves have been based upon the assumption that trains are allowed to coast after reaching maximum speed, and also that acceleration is carried on at a perfectly uniform rate until power is shut off, but in practice this assumption may be modified somewhat, the starting resistance being cut out before the maximum speed is reached, and the latter part of the acceleration carried on at a constantly decreasing rate upon the motor curve.

Another method would be to accelerate at a constant rate until maximum speed is reached, then continue this speed constant by supplying motors with just sufficient power to overcome train friction. This latter method of train acceleration, however, demands such a considerable increase in the amount of energy required for the run that it has not hitherto been considered.

The area enclosed by the energy time curves is a measure of the average energy consumption for each run, and their respective values reduced to watt hours are: a. Constant current and coasting, 147 watt hours per ton. b. Constant current and no coasting, 160 watt hours per ton. c. Constant current and acceleration on motor curve, 126 watt hours per ton.

Of the three methods, the one making use of the acceleration due to a series motor curve, not only requires the least maximum current input, but also requires the least average energy input to the motors for a given run and hence is the form of curve used in the majority of actual runs.

Whatever form of acceleration curve be used, the results arrived at in Fig. 2 will not be greatly modified if similar forms of curves are compared, and, being expressed in terms of actual work done, may be used for any run with a factor expressing the efficiency of acceleration: that is, the ratio of actual work done to the total energy input.

It will be noted that all curves of Fig. 2 approach a minimum value of 30 watt hours per ton mile, that is, the minimum energy expressed in watt hours per ton mile expended for a given run will be double the friction rate. The actual factor is 1.98 and forms a very convenient method of determining the net energy consumption for any speed and train weight if the friction rate be known. Thus, assuming the light load efficiency of a railway motor, including gear loss, to be 75 per cent., a friction rate of 15 pounds per ton would demand an input of 40 watt hours per ton mile, corresponding to an input of 1,200 watts per ton weight of train at, say, a constant speed of 30 miles per hour.

A number of interesting conclusions may be made from the foregoing investigation of the operation of trains upon a level track.

1st. The rate of acceleration determines the energy consumption for a given run, and since this energy consumption decreases with increased rate of acceleration, the train should be brought up to speed as quickly as possible and allowed to coast to secure the minimum energy input.

Digitized by Google

2d. The maximum current input during acceleration increases with the rate of acceleration, and hence limits the rate at which a train can be accelerated with a given feeder loss or feeder investment.

3d. In order to reduce the average energy consumption and also the maximum current input to a minimum for a given run, a due amount of acceleration should take place on the motor curve after starting resistance is cut out, hence a motor should be carefully proportioned for the work it has to do.

4th. A normal amount of coasting should be permitted after power is shut off, partly to provide a margin to allow for errors of judgment of the motorman, but largely because this is the most efficient method of accelerating a train. On no account should the maximum speed be continued by supplying the motors with just sufficient current to overcome train friction, as this method of accelerating is extremely wasteful and inefficient.

Having discussed various methods of accelerating, it is interesting to follow out the problem, and determine the actual efficiency of transporting passengers by our modern methods of travel. It has been pointed out that only from 15 to 20 per cent. of a fully loaded train consists of a paying load, and with an average load as carried throughout the day this percentage will be reduced to 10 per cent. or less, that is, nine-tenths of the energy consumed in moving this train at a constant speed is wasted. But in rapid transit work a train seldom attains a constant speed, due to the frequent stops and high schedule speed, and at least ten times the energy required to overcome friction alone must be expended in accelerating the train, only to appear as heat in the brake shoes when bringing the trains to rest. That is, considering the friction work of the train as the only useful work done, an efficiency of only 10 per cent. is reached in the average run. But only 10 per cent. of this friction work is useful in moving passengers, hence the actual passenger efficiency is reduced to less than one per cent. of the total energy delivered to the train during acceleration.

When it is considered that further losses occur in operation in the motors and their method of control, in the transmission lines and generators of an electric traction system, it will be appreciated that the present method of transportation, with its efficiency of a fraction of one per cent., opens a wide field for improvement. This applies with greater force to rapid transit service using steam locomotives as a motive power, as the dead weight carried per passenger is greater with a steam locomotive than with a motor car, and the efficiency from the coal pile is much less. Hence some means of reducing the large loss, due to accelerating the train is desirable, and this is found in the adoption of an artificial profile, as followed out in a large underground road now building, using down grades in starting, and up grades to retard the train when stopping.

The ideal profile would provide for a down grade at starting sufficient to do the work of acceleration and with an up grade to do the entire braking required, thus leaving only the friction energy to be supplied by the motive power. Such a road would operate at 100 per cent. efficiency, neglecting the dead weight of train carried and considering total friction work as useful work.

Reduced to practice, this ideal grade must be modified considerably. The per cent. grade used is limited partly by the rapidity of acceleration that may be imparted to the train without discomfort to the passengers and partly by the available tractive effort of the motive power, which must be sufficient to haul the train up the grade in case of necessity.

A second modification occurs in the necessity of having stations placed on a level track, and since a train has an appreciable length, it must travel its own length before the last car is off the level and the full effect of the grade is felt. Thus, during the first period of acceleration the rate is comparatively small and must be furnished by the motors, resulting in a material reduction in the energy gain in the theoretically ideal profile. An artificial profile can only be secured on elevated or underground roads, and a double track road necessitates two separate overhead structures and the underground road must consist of two separate tunnels with unlike profiles.

Assuming two stations to be on the same level, there are two forms of profile that may be assumed with a given maximum difference in levels, as shown in Fig. 3. Profile a consists of a down grade with a level track at each terminus equal to the length of train operating over the road, while profile b consists of a down-grade and up-grade equal in length and percentage with a level track connecting them, and also a level track at each station equal to a train length.

In practice a perfectly symmetrical profile, as in b, will not be possible, as the level tract connecting grades must be replaced by a slight grade to provide for drainage in tunnel roads, this grade preferably opposing the direction of movement of the train.

In order to ascertain the behavior of a train upon the two forms of profiles and to determine the most efficient form of grade, a series of curves have been plotted upon the following assumptions.

Length of run total, 2,000 feet; train friction, 15 pounds per ton constant; braking effort, 150 pounds per ton during time brakes are set; running time, 75 seconds; length of train, 200 feet, corresponding to an average train of four to five cars; tractive effort, as supplied by motors, 100 pounds per ton. (This effort being supplied irrespective of added effort due to grades.) No running is assumed to take place on the motor curve, and train is supposed to coast after reaching maximum speed. Motors are controlled by the ordinary series parallel method, starting with two motors in series and throwing them into multiple, the starting resistance being supposed to be cut out uniformly so that 100 pounds per ton motor effort is maintained constant while current is on.

Due regard is paid to the fact that the tractive effort due to grade depends upon the proportional length of train off the level track at the stations, and hence is a constantly increasing quantity until the entire train is on grade.

A grade of four per cent. has been chosen for the down-grade in a, and for both down and up grades in b; and energy consumption plotted in Fig. 3 for different lengths of grade.

Thus for a run of 2,000 feet in 75 seconds, the energy input with series parallel control is 40.75 watt hours per ton for a level track, which is reduced to 27.8 watt hours in curve a with a length of 500 feet, 4 per cent. grade and 22.6 watt hours per ton in c, with the same length of 4 per cent. grade, that is, with the same vertical fall.

A length of 500 feet of 4 per cent. grade calls for a vertical fall of 20 feet, which is not excessive in practice, hence by the use of a profile similar to b, Fig. 3, the energy consumption for a given run may be reduced as much as 40 to 50 per cent. from that required on a level track.

With proper proportioning of the gear ratio of the motor allowing some acceleration on the motor curve, this saving in energy consumption could even be exceeded, so that a rapid transit road, especially a tunnel road, properly laid out with an artificial profile, could operate with a very much less energy consumption than an existing surface road.

In conclusion it may be pointed out that the electric motor is eminently adapted to rapid transit service, owing to its ability to accelerate rapidly; and for tunnel work especially, it has no rival, adding to its high efficiency of operation its perfect immunity from smoke and gases.

Cost of Operating Electric Vehicles.

"L'Eclairage Electrique" states that the cost per kilometer of electrical vehicles at the time trials in Paris was about 0.5 franc, on the basis of a charge of 0.03 franc per k. w. hour, at which it is sold at the Place Clichy secteur station. Each vehicle expended current to the extent of 2½ to 3½ francs' worth on the route of 60 kilometers, the current consumed varying from 9.73 k. w. hours up to nearly 14 k. w. hours in different vehicles. Petroleum vehicles cost very much more. The minimum consumption of petroleum by the Peugeot vehicle was 13 liters per day. Petroleum cannot be bought for less than 0.6 franc per liter. Thus the journey cost would be 7.8 francs, or practically 78 pence for 39 miles, being practically 4 cents per mile—an amount heavy enough for two persons, being equal to a third-class railway fare. The expense in repairs, etc., of the electric accumulators has been given as 3 francs per day per vehicle. Added to the cost of the energy, this implies a cost of about 6 francs, as against 7.8 for petroleum.

TRAIN LIGHTING. It is figured that there are 6,000 railroad cars in Europe lighted by electricity, while the number in this country is sensibly rated at much less than 1,000. The European statistics seem very much open to doubt.

Digitized by Google

Columbia Electric Motor Carriages.

AMERICAN manufacturers at an early stage foresaw the demand for automobiles, and have gradually, but quietly, developed types and invented apparatus which now in their more perfected forms are being placed before the public. The

COLUMBIA MOTOR CARRIAGE, MARK III.

success attained by the manufacturers on this side may be judged by the fact that the Columbia motor carriages placed side by side with all the latest and best types of foreign makes at the late Paris Exhibition easily outranked and outsold them. Several of these carriages, manufactured by the Pope Manufacturing Co., Hartford, Conn., were shown at the recent New York Electrical Exhibition, where they attracted considerable attention. In our issue of May 26 we described the construction of these vehicles in great detail and pointed out many important improvements. Since that time, however, additional details have reached us which will doubtless prove of considerable interest:

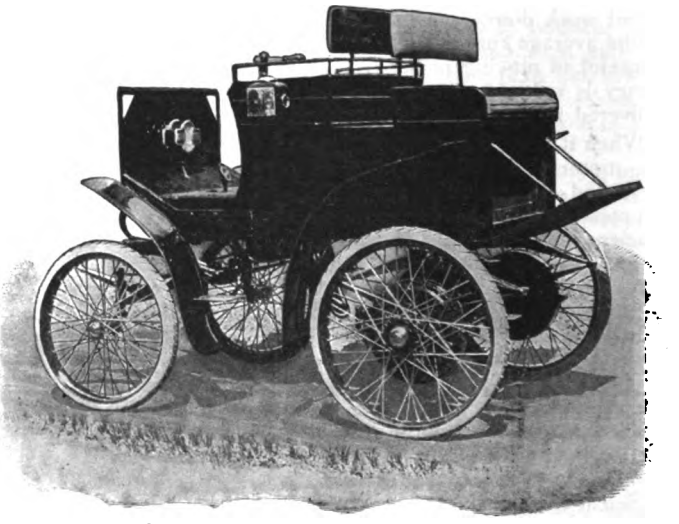
STORAGE BATTERIES.—The storage batteries supplied with the carriages are of a type best adapted to meet the required conditions of greatest efficiency with the least weight consistent with long life and ability to stand a certain amount of abuse and neglect. They can be charged from any 110-volt direct current circuit. Under ordinary conditions, the process of charging the batteries from completely empty to completely full requires about three hours and is extremely simple. The batteries are assembled in such a way that the leakage of cur-

COLUMBIA MOTOR CARRIAGE, MARK IV.

rent is reduced to a minimum and, unless the current is used to run the carriage, they will remain charged for a considerable period. When the recharging of a carriage has been completed the current is automatically cut off, and the purchaser relieved of all anxiety on account of waste of current. If the batteries are reasonably well treated or given the same relative care as the horse, they will drive the carriages over thirty miles on level roads on one charge, and on roads and streets of the average city quality and possessing such grades as are common in our New England cities, will average on each charge a mileage of over twenty-five. The batteries used will, with reasonable care, last for more than 5,000 complete discharges; this, of course, representing a life almost indefinitely long for ordinary uses.

It seldom happens, where the current is taken from wires connected with the city mains of central lighting stations, that the cost for each full charge exceeds 60 cents. As is well known, electric lighting and power companies usually base their prices for their output on the amount of current consumed, and when a user of a carriage also employs the same electric current for lighting his house, or for any other purpose, he can arrange to charge his carriage batteries at a cost extremely slight. It has been found that the average cost of running a Columbia carriage is one cent per mile for current when taken from a public station. It frequently happens that owners of these carriages possess their own private electric plants, and when this is the case, the cost is even less, and under favorable conditions is sometimes as low as one-quarter of a cent per mile.

MOTORS.—In the single seated phaetons of the Mark III pattern, illustrated herewith, as well as in the two-seated dos-a-dos Mark VI traps, also shown in the illustration, a single motor of a normal capacity of slightly over 2 h. p. is employed, and on the double-seated carriages of the Mark IV pattern, two



COLUMBIA MOTOR CARRIAGE, MARK VI.

motors each of 2 h. p. capacity are used. All motors are especially designed for their particular use, are light, strong, and compact, and in common with electric motors generally will respond to a demand for more than double their normal capacity, when they are called upon to do so. Although, in order to be water and dust proof, they are completely encased, that part of the covering over the commutator and brushes can be quickly removed for such inspection as may be occasionally necessary.

WHEELS.—In a motor carriage, the weight, the great strains in starting, and the other trying conditions which do not exist in a horse drawn vehicle, call for wheels especially adapted to meet especially exacting requirements. The wheels on these carriages are thoroughly constructed in every detail of steel and forgings on the same lines as bicycle wheels, although many times heavier and stronger, have tangent spokes, and are absolutely reliable and capable of resisting the peculiarly severe strains of motor vehicle use. The front wheels are 32 inches in diameter, and the rear ar driving wheels 36 inches on all the patterns of the Columbia electric carriages.

The tires are pneumatic, 3 inches in diameter, and of a specially durable construction, being not readily puncturable under any probable conditions. They are provided with a corrugated or "herring-bone" tread, which prevents their slipping even on asphalt pavements in wet or wintry weather when the use of horses is dangerous.

BEARINGS.—Every mechanical refinement and all service-

Digitized by Google

able features of bicycle construction, as developed by the Pope Mfg. Co., have been embodied in the Columbia electric carriages. The wheels are fitted with ball bearings, which add considerably to the ease of running and economy of power. Ball bearings are also used wherever else in the vehicle they can be of possible benefit.

FRAMES.—The frames are of special steel tubing, manufactured and tested for this particular purpose. They are rigidly braced and extremely strong, although as light as possible. As is the case with all other steel material employed in these vehicles, the tubing was made to precise specifications of the same exacting nature as those set by the United States Government for the material it purchases.

SPEEDS.—The carriages are designed for an average maximum speed of slightly over twelve miles per hour on the level. There are also two lesser speeds, one of six and one of three miles per hour. As the legal limit in most cities is eight miles per hour, it would appear that the company have amply provided for all contingencies of ordinary use. Indeed, their experience has proven that one of their standard carriages possesses just the requisite range of speeds for all ordinary city and park riding, it being possible at any time to go ahead of or proceed slightly faster than most ordinary passenger carriages. All three of the speeds can be obtained backwards by a very simple manipulation. The great importance of this has been apparent to the owners of such carriages who have had occasion to go with them to the lower part of New York during the busy hours.

MANNER OF CONTROL.—In the left hand of the operator is held the controller handle, which is moved easily and with positive action through four positions from "stop" to full speed. It can be left continuously on any one of these positions, being fixed firmly until again moved by the operator.

The steering handle is held by the operator in his right hand, and the process of guiding the vehicle is much like steering a boat. The brake and reversing lever, mentioned later, are within easy reach of the left foot, and are immediately effective when put into operation.

BRAKE.—The brakes with which Columbia carriages are equipped are trustworthy. The principle of their use consists in the tightening of a band of bronze over an iron drum placed on the shaft of the driving wheels. This is done by a foot lever worked by the person running the carriage and is perfectly effective under any conditions.

RUNNING PLUG.—A very valuable feature in the carriages is what is termed the running plug. It consists of a small, aluminum, specially shaped key, which is inserted in the main circuit between the batteries and the motor, at a point where it is led up to a position convenient to the left hand of the operator. This plug, when removed, prevents the carriage from being started.

LAMPS.—Every Columbia carriage has four electric lamps, all controlled by switches within convenient reach of the driver's hand. There are provided the two lights, one on each side, commonly found on carriages. A head light is attached to the front of each vehicle just below the dash board, throwing a light forward so brightly that ordinary newspaper print can be read at a distance of over forty feet.

WARNING SIGNAL.—Each carriage is provided with an electric bell which is rung from a push button placed in the end of the controller handle at the left of the driver. It is sufficiently loud to accomplish its purpose, even where the din of traffic is excessive, without, however, being objectionable at any time.

WATTMETER.—A meter is provided, in sight of the operator, which shows at any time to what extent the supply of power in the batteries has been used. This meter is also used when charging the batteries and enables the attendant to know when they are charged.

UPHOLSTERY AND FINISH.—One of the chief objects which was kept in mind in the production of these electric vehicles was to avoid the awkward and cumbersome look and the resulting unpleasant impression conveyed by automobiles. The company therefore secured the co-operation of a firm of well known carriage makers. The bodies of the carriages are similar in design to the latest models now in vogue.The upholstering is of imported whipcord of absolutely the best quality. The cushions are stuffed only with the choicest curled hair. The coloring of the seat panels is in a dark rich green. The bodies are absolutely black and the gears are painted to match the seat panels, picked out with just enough bright red to make them attractive, yet not loud. The most careful attention has been given to details, which are always necessary in the production of strictly high grade work.

The results of these efforts to produce a beautiful motor carriage is considered eminently satisfactory. The finish and upholstery are of the very highest order, and all the appointments are comparable to those of the most stylish park phaeton or Victoria.

WEIGHT.—The total weights of the vehicles vary from approximately 2,000 pounds in the smallest to 3,500 in the largest. For these weights the batteries are responsible for one-third.

HILL CLIMBING.—The Columbia carriages are able to take any ordinary city grades without difficulty, and can climb easily ascents possessing a rise of not over fifteen feet in each hundred. In cases, however, where a carriage is to be used in an abnormally hilly country, the company is prepared to equip it with a special low gear, which will enable it to climb hills possessing grades even steeper than 15 per cent. at a speed considerably more rapid than the gait which a horse would take in doing the same work.

PRICES OF VEHICLES AND BATTERIES.—For the three carriages shown in the cuts the prices are as follows, all f. o. b. Hartford, Conn.: Mark IV., $3,000; Mark VI., $2,750; Mark III., $2,500. Extra storage batteries will be supplied for the following prices per set, ready for placing in the carriage and connecting up, prices f. o. b. Hartford, Conn.: Mark IV., $525; Mark VI., $425; Mark III., $375. These figures make the storage battery compare most favorably with the horse in its relation to the carriage proper, and assist in disabusing the average mind of the confusion resulting from an attempt to compare what appears to be a carriage alone with a carriage and horses, harnesses and equipments, when in reality the first as it stands takes the place of the second with horses, accessories and equipment complete.

The Baldwin-Westinghouse Electric Mining Locomotives.

ON account of its extreme flexibility, permitting ready extension or change as mining conditions frequently require, electricity has been established as the most convenient and economical form of motive power for mine haulage. The compactness of the electric locomotive makes it perfectly adaptable to low and narrow entries; and, by reason of the absence of moving parts exposed to external injury, mechanism of the simplest possible character, and running parts readily accessible for replacement, the cost of maintenance is brought to a minimum.

The power for operating electric mine locomotives may conveniently be furnished from the same electric generating plant which supplies current for lighting and other mining work, and the same wires may be made to convey the current for all purposes, thus making a simple system of distribution and reducing the attendance to the minimum. These advantages were early recognized, and numerous types of mining locomotives were devised and tried. A number of these proved successful, but when it was announced a few years ago that the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company had joined forces and were going to manufacture electric mining locomotives, electrical and mining engineers expected with confidence a well designed and efficient machine. The extended experience of the Baldwin Locomotive Works in the manufacture of steam and compressed air mining locomotives assures careful design of the mechanical features of the locomotives, while the well known excellence of the electric railway apparatus of the Westinghouse Electric and Manufacturing Company guaranteed that the specially designed motors for these locomotives would embody the latest improvements in electrical practice.

After a number of years of experimenting with various types of locomotives, this powerful combination has recently brought out the machine illustrated in perspective in Fig. 1. The locomotive frame consists of heavy cast iron side and end pieces securely bolted together and kept square by machined joints and shoulders accurately fitted. These frame pieces are planed top, bottom and ends, to insure perfect accuracy in fitting up and interchangeability of parts. The pedestal caps are forgings

Digitized by Google

made to templet, and accurately fitted, so as to relieve the frame from breaking strains in case of severe shocks. The frame is placed outside of the wheels, thus allowing all possible space between wheel hubs to admit the greatest practicable width of motor. This feature is of much importance in obtaining the maximum power on narrow track gauges. Furthermore, this construction permits of ready accessibility to the journal boxes, and protects all moving parts in case of derailment. Heavy planking with hinged doors is laid on the frames, thoroughly protecting all electrical parts, but permitting access for inspection. End bumpers and coupling hooks are provided in conformity with purchaser's requirements.

The journal boxes are of ample dimensions and have bronze bearings with oil cellars for sponging, as in steam locomotive practice. The brake apparatus, which is fitted to all wheels, is of simple design and of sufficient power to utilize the track adhesion due to the weight of the locomotive. The operating platform is placed at one end, and is compactly and conveniently arranged so that the motorman has all levers within reach without leaving the seat. The entire machine, with electrical apparatus, is supported on the journal boxes by helical springs, which prevent destructive pounding on the track and relieve the machinery from shock. The locomotive is driven by two spring supported motors, one geared to each axle by single reduction gearing running in oil lubrication in tight cases. These motors are designed especially for mining service and are of the four-pole, steel clad, enclosed railway type. The armature is of the iron clad type, the coils being held in slots below the surface and secured from displacement, as in the most approved railway practice.

The current controller is the latest rheostatic type, with magnetic blowout to prevent arcing at the contacts. It is provided with six speed changes, and is operated by handles for starting and reversing. The rheostat or "diverter" is of a non-combustible type, very compactly set up, and has large carrying capacity.

The trolley pole is specially designed for this service; it is reversible and can be placed in a socket in either side of the frame, and automatically adjusts itself to varying heights of trolley wire. It is thoroughly insulated to prevent shocks to the operator when being handled, and the current connections are made by insulated cable. The locomotive is provided with all necessary minor electrical fittings, such as fuses, lightning arrester and main switch and two electric headlights. All sizes are designed to run at a standard speed of eight miles per hour when developing their full load tractive effort. With light trains, requiring less than full load upon the motors, the speed of locomotive may be increased. When starting, the train is brought gradually up to full speed by means of the controller.

Fig. 2 shows a side view of the frame of the locomotive and having reference to the letters on this figure the standard sizes of the locomotives are as follows: There are five sizes ranging from 20 to 150 h. p.; the draw-bar pull on a straight level track from 900 to 6,500 pounds; on a 4 per cent. grade from 660 to 5,140 pounds. The minimum track gauge varies from 24 to 56½ inches; wheel base C from 24 to 36 inches; width 41 to 74 inches; length A 10 feet 4 inches to 13 feet 6 inches; height F 33 to 42 inches, and the weights ranging from 7,000 to 34,000 pounds.

A large number of these locomotives have already been installed, and judging from the satisfaction which they have given everywhere, it appears as if the Baldwin-Westinghouse locomotive meets admirably the difficult conditions presented by mine haulage.

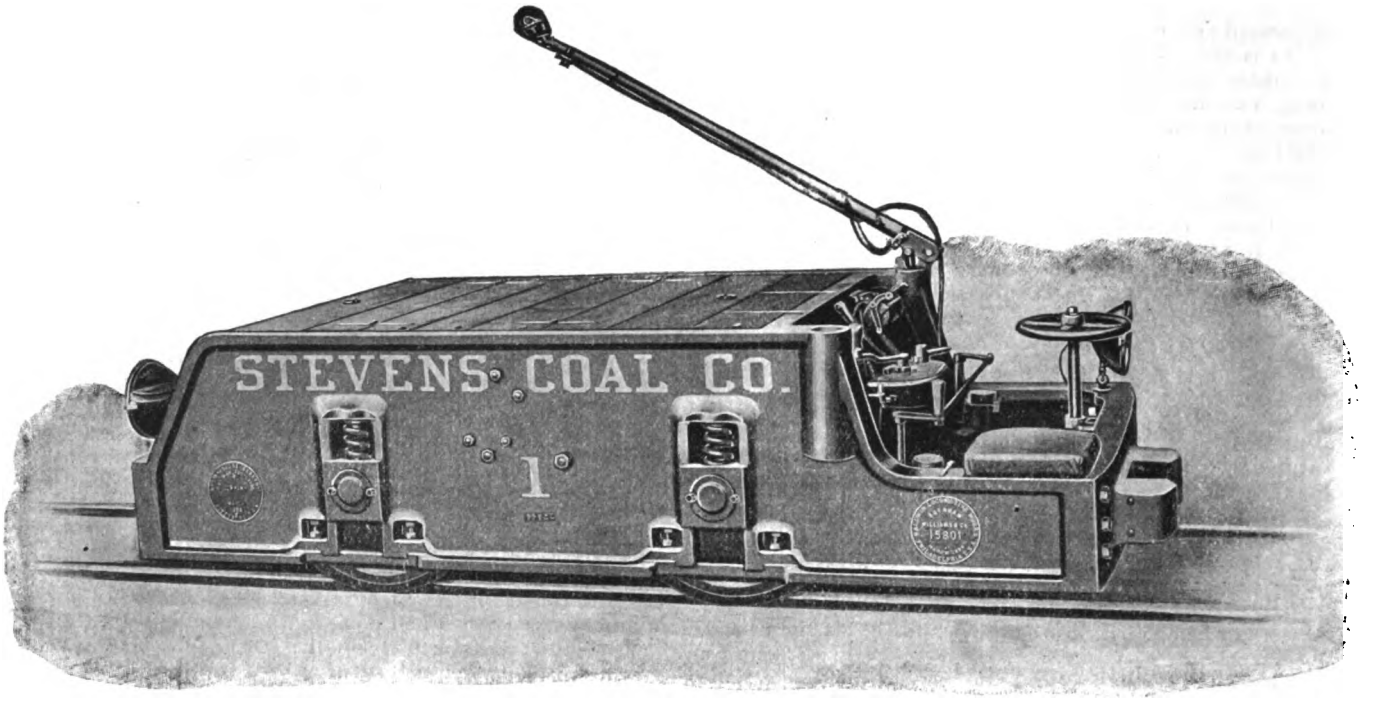


FIG. 1.—BALDWIN-WESTINGHOUSE ELECTRIC MINE LOCOMOTIVE.

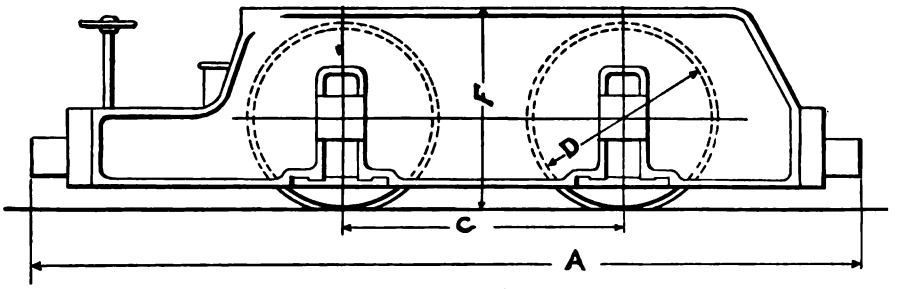


FIG. 2.—SIDE VIEW OF BALDWIN-WESTINGHOUSE ELECTRIC MINE LOCOMOTIVE.

Digitized by Google

The Eddy Electric Carriage Motor.

THUS far in spite of the limitations of the storage battery, the electric carriage has most successfully met the requirements. Careful investigation has shown that rarely does the daily distance traversed by the horses drawing city carriages, physicians' phætons, hacks, hansoms, express and delivery wagons exceed twenty-five miles, and the average distance is much less than this. Without too great a weight of storage battery an electric carriage can easily accomplish this distance on one charge, and as it is clean, free from odor, practically noiseless, and easily handled, it has the advantage over other forms of propulsion, all of which lack one or more of these characteristics. It of course cannot, under existing conditions, pretend to be available for long distance work, but in its province is certainly a commercial success.

In order to attain the successful results reached, the manufacturers of the American carriages have had to call on the makers of storage batteries and electric motors for apparatus to meet the peculiarly severe requirements of the service, and consequently new types have had to be designed for this work.

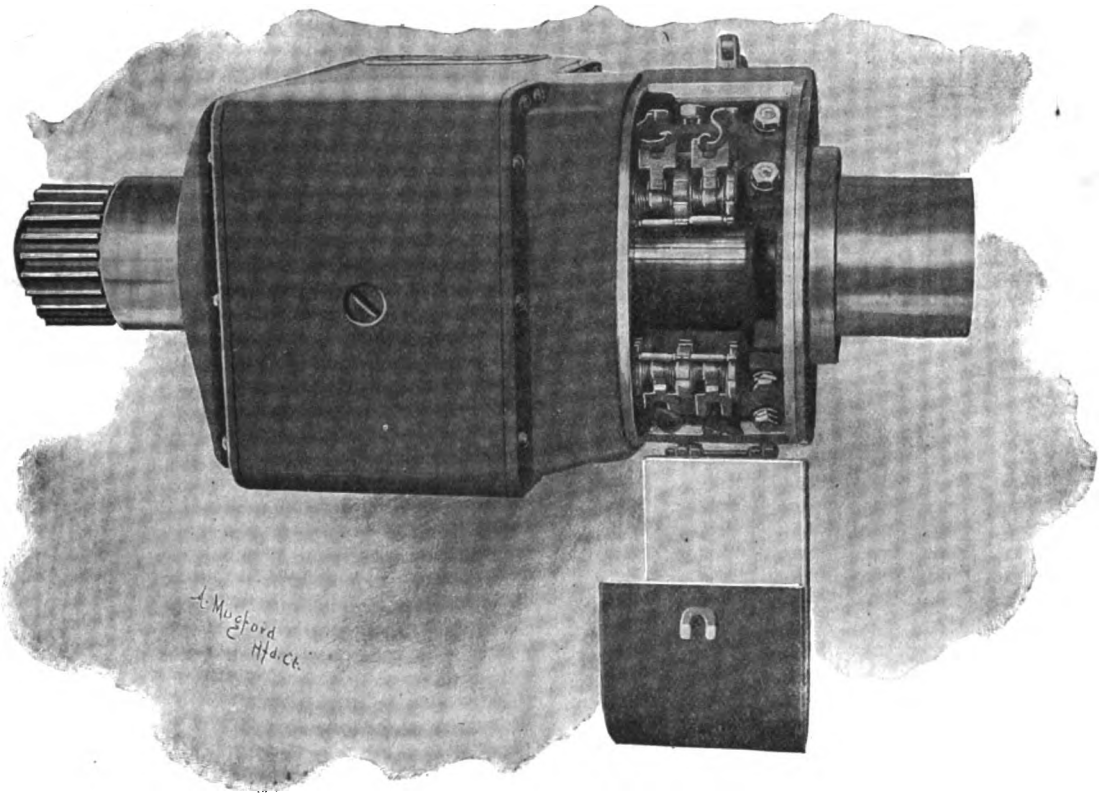
The conditions under which the motor or motors of an electric vehicle operate are similar to those governing in street car work. The ratio, however, between maximum load and average load is much greater than with the trolley car, for every kind of roadbed may be found from sheet asphalt to thick mud, and any grade that a horse can climb must be ascended by the electric carriage. The motor must therefore have great capacity above that at which it is normally expected to run.

For the economy of the stored energy the motor must have as high a commercial efficiency at the average load as possible, and this efficiency at heavy overloads must be maintained in order to minimize the strain on the battery. The efficiency of the motor at loads less than the average is not of great importance if the battery is properly proportioned for the work. Such loads occur when the carriage is on a declivity, and at these times the current drawn from the battery is very light.

It is of course desirable that the motor shall be of as little weight and small dimensions as is permitted by the power and speed required. It must also above all things be "fool proof," that is, must be so constructed as to require no attention whatever and to withstand all kinds of abuse.

The illustration shows a typical electric carriage motor adapted to meet the requirements as above set forth. It is designed for an average current input of 20 amperes, and with this current and at 75 volts will run at 1,000 r. p. m. It will carry this current continuously without dangerous heating, and 40 amperes or 100 per cent. overload for twenty minutes without a rise in temperature exceeding 75 degrees Cent. above the air. It will also withstand loads up to 100 amperes for short periods. This capacity has been found to be ample for driving a two-seated carriage weighing about 1,800 pounds at a speed of about twelve miles an hour over good macadam roads, and is ample for ascending any hills likely to be encountered. For four-seated carriages two motors of this size are used. From 75 to 80 volts seems to be a convenient pressure at which to rate motors for this work, as this is about the minimum e. m. f. of discharge for a storage battery, at normal current, which may be charged from a 110-volt circuit direct. The speed of 1,000 r. p. m. is sufficiently low to permit of convenient gearing with the axle of the carriage.

In order to secure as light weight as possible, the motor is made with a field frame of Norway wrought iron forged to a rectangular shape and having two salient and two consequent poles. To this frame are bolted at either end cast aluminum casings, which support the rings for ball or roller bearings. The armature is mounted on a hollow shaft so that it may be suspended concentrically with the main axle of the conveyance. The armature winding consists of machine formed coils laid in slots cut in the surface of the laminated core. This form of construction is extremely light, but should only be used where the method of motor suspension supports the bearings directly and thus relieves the strain of the gears on the aluminum casings. The motor above described weighs complete but 128 pounds, a surprisingly low result when its power and efficiency are considered.



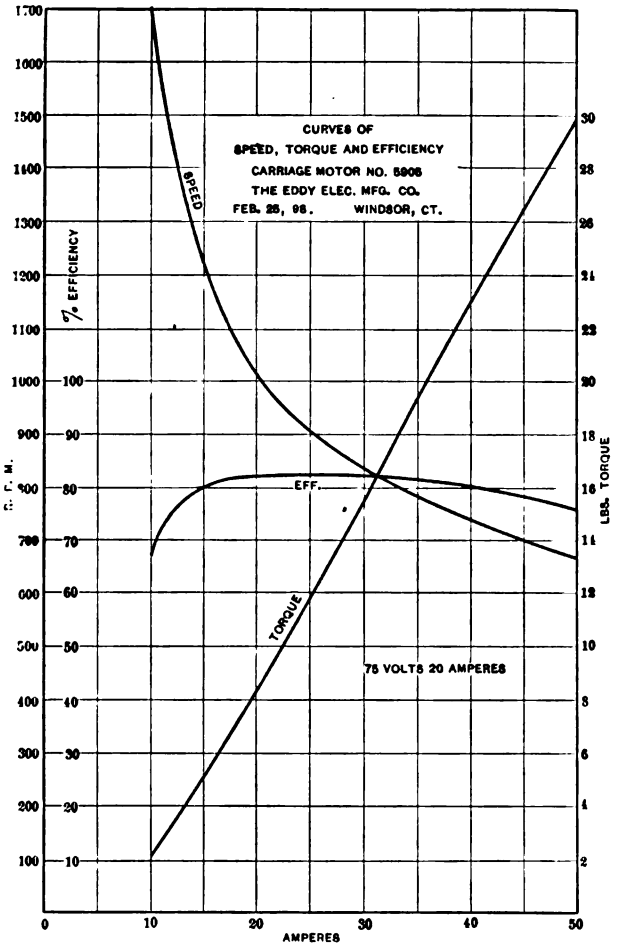
THE EDDY ELECTRIC CARRIAGE MOTOR.

The appended curves show the speed, torque and efficiency of one of these motors as found from an actual test with a Prony brake. The efficiency curve is the most interesting, perhaps, as upon it depends the range of operation of the carriage. It is noticed that the efficiency rises almost in proportion to the current until the normal load is reached, and from that point maintains a high reading up to 35 amperes or 75 per cent. overload, dropping so gradually after this that it is still remarkably high at 150 per cent. overload. As already stated, the maintenance of high efficiency from normal average load to heavy overloads is extremely desirable. It can only be obtained on

Digitized by Google

such small machines by making exceptional efforts to reduce the internal resistance as low as possible. Extra care must be taken not only with the windings, but in all contacts. Especially is this true with the brushes and brush holders, and in the motor from which the above data was taken the holders were designed so that current was drawn from the self-feeding brushes without reliance at all on the sliding contact. Ball or roller bearings and low armature loss also contribute to the high efficiency attained.

As the motor is suspended usually under the carriage frame it must be, of course, dust and water proof. It is subjected also



CURVES, OF SPEED, TORQUE AND EFFICIENCY, EDDY CARRIAGE MOTOR.

to exceptionally severe jars and vibration, which tend to abrade and destroy insulation which under ordinary circumstances would be perfectly satisfactory. This brings before the manufacturer a problem, not easily solved even by those having had experience with railway work.

The motor which has been illustrated and from which the data is taken is one manufactured by the Eddy Electric Mfg. Co., a concern that has had considerable experience with this class of work, and which has furnished motors of different types and sizes for the various electric carriage makers of the country.

A Big Prize for an Automobile Accumulator.

At the last meeting of the committee of the French Automobile Club a letter which had been received from a firm of accumulator manufacturers was read. In this letter the firm, whose name was not made public, offered to set aside a sum of $5,000, to be given to the maker of any accumulator which could be proved to be better than their own. The committee resolved to write to the firm in question, stating that they were willing to accept the $5,000, and to make it a prize for the best accumulator in the secondary-battery competition, which it is proposed to hold next winter.

HAWAIIAN TROLLEYS will probably be put in by some Buffalo men connected with the Buffalo Railway Co., who are after the Honolulu franchise.

TELEPHONY AND TELEGRAPHY

Who Shall Pay the Telegraph Tax?

The Illinois Manufacturers' Association, Chicago, will bring a test case against the telegraph companies to decide whether the companies or the customers shall be required to furnish the revenue stamps affixed to telegrams. Levy Mayer, counsel for the Manufacturers' Association, will begin the case against one of the telegraph companies as soon as a similar case against the United States Express Company has been decided.

The North Carolina Railway Commission has taken action on complaints against the Southern Express Company and Western Union Telegraph Company for exacting and collecting from shippers and senders of messages a higher rate than that fixed and approved by the commission, by forcing the payment by shippers and senders of the revenue tax stamps. The express company and telegraph company are cited to appear July 29 and show cause why the penalties for overcharges should not be enforced. They are also ordered to furnish to the commission sworn statements of the number of messages or shipments upon which overcharges have been made between July 1 and July 29.

KANSAS CITY, MO.—A great deal of angry comment is made because in the case of a message conveying the news of a sudden death, the telegraph operator refused to take the message on the ground that it did not bear the 1 cent revenue stamp.

Pacific Cable Schemes.

A London special dispatch of July 20 says: "The Pacific cable is again moving. Hon. Mr. Mulock, Canadian Postmaster General, yesterday met the Australian agents general, and went fully into the best means of bringing the project to a conclusion, especially in view of the probability that unless the British cable is shortly laid, the Pacific may be crossed by non-British telegraphs, namely, a cable from San Francisco to Hawaii, with extensions to New Caledonia, connecting with the French cable to Australia. The greatest obstacle to the British project is just the permanent officialdom which Mr. Chamberlain had to overthrow before imperial penny postage could be carried."

The Telephone and the Hotels.

A well known landlord of Boston and New York is quoted, says the Boston "Advertiser" as telling mournfully about an instance in which a company of business men in this city who deemed it necessary that they should all go in a body to St. Louis to confer with a number of business men there upon important matters, discovered to their own great surprise that at an expense of just $11.50 they were able to transact all their business by long distance telephone; and thus save the difference between that small sum and at least $300, which would have been required for traveling expenses. Besides, there was a saving of nearly a week's time for each of the Boston men concerned.

Yes, there is no doubt that this sort of thing is increasing, and that it is correspondingly diminishing the profits of landlords and railway companies. But let our genial Boston boniface take courage. The long distance telephone will not altogether take the place of the old method, of extending the glad hand and sitting down to talk over matters face to face. For instance, a Boston business man cannot very well say to a St. Louis business man, by long distance telephone, "What's yours?"

Government Controls the Santiago Cable.

The West Indian and Panama Telegraph Company has sent the following notice to the Western Union Telegraph Company's central cable office: "The American Government has taken possession of the cables at Santiago de Cuba, and no communication via Jamaica and Santiago will be allowed until further notice."

Digitized by Google

A special dispatch from Washington of July 20, intimates also that Governor Blanco cannot do any more of his tall lying for foreign consumption. It says: "Gen. A. W. Greely, Chief Signal Officer, cabled instructions two days ago to his officers in Santiago to seal up and place a guard over the three cable lines connecting Santiago with Cienfuegos, whence by a land line communication is established with Havana. To-day Gen. Greely was informed that his orders had been carried into effect. The closing of the Cienfuegos cables absolutely isolates Havana and Gen. Blanco from Madrid. Blanco's only means of communicating with the Government at Madrid now is by the Key West cable, which is under the strictest censorship by the Government of the United States. As a result of the sealing of the Santiago-Cienfuegos cables, several cipher dispatches passing between Gen. Blanco and the Spanish Government drifted into this country to-day. It is scarcely necessary to say that they did not reach their destination. The final cutting off of communication between Blanco and his home Government is a source of great satisfaction to the Administration, and is another laurel for Gen. Greely's active vigilance."

The Telephone Toll Tax.

Mr. Charles Flowers, of the Independent Detroit Telephone Co. says: "People probably do not know that the war tax falls more heavily upon the Independent Telephone Company than upon the Bell concern, but that is a fact. The law puts a one-cent tax upon each message costing 15 cents or more. Now, none of our messages cost more than 25 cents, because the Detroit Telephone Company and its branches do no business outside of the State of Michigan. The Bell Company handles messages running anywhere from 10 cents up to that number of dollars, but they pay only the one cent, no matter how much the messages to New York or Boston may net them. You see, on the basis of our dearest message, 25 cents, we pay a 4 per cent. tax, which is rather heavy. And we pay it, too. We don't make our patrons pay the tax."

Report Against Municipal Telephony at Columbus, O.

The special committee appointed by the Columbus, O., City Council to investigate the advisability of establishing a municipal telephone system in Columbus has made a majority report and asked that the committee be discharged and that for the present the Council refuse to further consider the subject.

When the committee was appointed it was at the request of Mr. Marshall, and was instructed to investigate the municipal ownership system and report to the Council whether or not in their judgment it would be wise at this time to attempt to put the system into operation in this city. When the committee reported they came in with a majority and a minority report by Mr. Marshall, who wants more data. The former was submitted by A. E. Evans and F. W. Wiechers, and was adopted by the Council. They stated in the report that the committee had visited Toledo and Detroit and there studied the systems in use and came to the conclusion when they had finished that this city wanted nothing of that sort. They said in Toledo they had found that the system was in such bad repair that they would not admit visitors to their exchange room. They said in the other places they found the same thing. Everywhere the Union Bell Telephone Company had the better plant and the work of the smaller ones was not at all satisfactory. They said also that the people are dissatisfied with having the two systems, as it in almost every case necessitates having both of them in the one place. They said in their investigations all through the country they had the idea that two lines were not at all popular and then it was almost now an impossibility for them to have a communication with another city when they had the city owning all of the line in its bounds. Another thing, they said, was bothersome, and that was that the laws of the State would not permit them now to have the municipal ownership of the plant, or at least there is no provision for that in the laws of the State. There was a resolution introduced into the Legislature at the last session recommending the laws be changed so as to permit that, but it was voted down by a very great majority. They recommended that the Council leave that matter for the present until there should be a new Legislature. They further recommended the director of law should communicate with the Legislature with reference to having a law passed that would permit the cities of the State to establish a system of that sort. They referred to the statute that provided for all of the improvements in a city, such as sewers, lighting and waterworks, but said the telephone was not included.

Municipal Telegraph Chiefs to Meet.

Preparations for the annual convention of the Association of Chiefs and Superintendents of Fire and Police Telegraph and Municipal Telegraph Systems, which is to take place in Elmira, N. Y., on August 9 and 10, have been made by Will. Y. Ellett, the president of the organization, who is in charge of the municipal telegraph and telephone system of Elmira. A number of papers on subjects of interest to the organization will be read, and Mr. Ellett says that the people of Elmira will hospitably entertain the visitors. The wish has been expressed that the superintendents and chiefs bring their wives. There will be a trolley trip to Horseheads, an interesting suburb, a dinner at a quaint little cottage at that place, a trip to Watkins Glen and a dinner at the hotel there.

OBITUARY

Edward Dexter Brown.

IT is with deep regret that we chronicle the death of Corporal Edward Dexter Brown, of Troop C, National Guard of New York. Mr. Brown was widely and well known in the electrical fraternity. Born in Reading, Mass., August 29, 1868, and educated in the public schools of that place, he entered the Massachusetts Institute of Technology and graduated in the class of '90 with the degree of Bachelor of Science. Shortly after graduation he entered the Engineering Department of the American Bell Telephone Co., and distinguished himself while there by his fertility of ideas and close application to business.

In September, 1891, he entered the employ of the American Telephone and Telegraph Co. (Long Distance Co.), as a special inspector, passing thereafter through the positions of New York manager and district inspector to that of the general inspector, a position which he held at the time of his resignation to enter the service of the United States Government. Mr. Brown was one of the most expert telephonists of his time, and his personality will be recognized in many branches of the art for a long time to come.

His connection with various societies will be greatly missed. He was a member of the American Institute of Electrical Engineers, the M. I. T. Society of New York (a member of its executive committee), the Brooklyn Institute of Arts and Sciences, M. I. T. Alumni Association, Crescent Athletic Club, Brooklyn Reform Club, and president of the Telephone Society of New York.

In 1897 Mr. Brown enlisted in Troop C, National Guard, State of New York, as a private. He volunteered on the first call and was mustered into the service of the United States on May 22, 1898. He was made a corporal shortly before his troop left for Camp Alger. On June 29 last he was stricken with typhoid fever and taken to the post hospital at Fort Myer, where he died on July 2. He leaves a widowed mother, a brother and a sister.

John Mason Jackson.

A SPECIAL dispatch from Honolulu says: John Mason Jackson, of Chicago, who was superintendent of the Western Electric Company, of Chicago, is dead. In search for health he went to Hawaii six months ago with Dr. Rozell. He died at the home of Dr. J. S. McGrew, and the remains were interred in Uunanu Cemetery. The Chicagoan was suffering from nervous prostration brought on by overwork, and had nearly regained his health, when he was stricken with diphtheria. He was 39 years of age, and a personal friend of President Harper of the University of Chicago.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico, - - - - - -	per year,	$3.00
Four or more Copies in Clubs (each). - - - - - -	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies, - - - - - - - - - - - -	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1882.*]

Vol. XXVI. NEW YORK, JULY 28, 1898. No. 534.

The Counter E. M. F. Method of Car Motor Regulation.

IN our last issue considerable space was devoted to the description of the Henry "Regenerative" controller for electric cars, and it was editorially compared with the system most in use at the present time, the series-parallel. The advantages claimed for the Henry system were so numerous and alluring that the opinion was expressed that tests of it on a large scale would be looked forward to with a great deal of interest by the profession. The radical departure from series to shunt motors and the regulation of the speed by means of the fields instead of the armature,as well as the absence of arc-extinguishing devices, are all features which speak favorably for the proposed system. However, other methods for motor control have been proposed in the past, such as the commutated field method, which consists in dividing the field into sections and changing the e. m. f. at the armature terminals; and the rheostat method in which rheostats are placed in series with the motors, the motors being placed in parallel at the start. These methods, however, have not survived, and the series-parallel controller reigns supreme in this country at the present time. It is economical in operation, gives perfect control of the speed of the car and an easy variation over a wide range; it permits the running of cars in crowded thoroughfares where slow speed is imperative and stops are frequent; it enables the cars to be run at high speeds as well; it does not necessitate frequent repairs and is not very expensive. Its disadvantages, however, are the possibility of one motor racing when the controller is in the series position and the current is applied suddenly; its unfitness to be applied to many motors on account of the unequal division of work; the liability of rushing the controller ahead of the car acceleration and the waste in all connections where an intermediate condition would suffice as well as in the use of resistances. Most of these disadvantages are claimed to be overcome by a system of control devised by Mr. Rudolph M. Hunter. This system requires no resistances and controls the speed of the motors by delivering to them a current of constant potential, varying the current, and interposing a varying counter e. m. f. independent of the counter e. m. f. of the motor in advance of changes in the speed of the motor. This is done in such proportion that the sum of the counter e. m. f. of the motor and the independent e. m. f. shall bear such relation to the initial e. m. f. of the current of constant potential as will offer the requisite resistance to the current desired. Mr. Hunter's invention is claimed to be of great importance in the operation of large motor cars, locomotives, or trains where the motor elements may develop 1,000 h. p. or more. No regulators proper are placed on the passenger cars, but, instead, the forward part of the train is provided with what may be termed a "pilot" car upon which are arranged the necessary controlling devices for simultaneously regulating the current to all the motors of the train. The regulator on the pilot car is a counter e. m. f. generator whose counter e. m. f. is made greater or less to oppose the initial e. m. f. to a varying degree. This generator can be made of a small number of coils of large size and be rotated at a very high speed. The main current then is passed through the generator, thence through all of the field magnets of the motors, thence back to the pilot car and through one part of a reversing switch, thence back through the armatures of all the motors on the cars, and finally returned to the other terminal of the reversing switch on the pilot car and back into the line. The regulator consists of two parts, a counter e. m. f. generator and a hand-switch device for varying the counter e. m. f. at will.

The pilot car which, as will be seen, is self-propelling, is enabled to shift itself in making up trains or for conveying itself from one place to another when detached from a train. The principal claims made by Mr. Hunter for this ingenious but complicated method are that his system permits the control of any number of cars in the simplest manner possible and with the least loss of electrical energy. Also that the wiring on a train is reduced to a minimum so as not only to reduce the expense but also the liablity of derangement. These claims are certainly worthy of consideration, as are also those of Mr. Henry, and it appears as if the wasteful and not otherwise altogether satisfactory series-parallel controller may soon find a rival in one or both of the above methods, or even in some other. It may be earnestly hoped that they will be thoroughly tested at an early date. Many good things go wrong for unsuspected reasons foredooming them to failure.

The Present Status of Electro-Dentistry.

WHILE it may be claimed that electro-therapeutics or the treatment of diseases by means of the electric current is of very early origin, it must be admitted that it received a marvellous impetus during the decade just coming to a close. This may be ascribed not so much to the perfection of electro-medical apparatus as to the proper electrical training of those engaged in surgical and medical practice. This in turn led to a correct study of the electrical effects on the human system and the laying down of certain definite laws governing the application of electricity. Wideawake to the possibilities of this new agent and its wonderful curative properties, the medical practitioners were ready to co-operate with the manufacturers of electro-medical apparatus in the design of instruments and appliances best suited for their requirements. Of still later origin, however, is the application of the electric current to dental surgery, where it had been employed but little until two years ago for the driving of mechanisms, cauterization, the translumination of soft tissue, the illumination of cavities, and other useful operations. It was at that time that Mr. Geo. H. Guy, in an able address before the N. J. State Dental Society, foreshadowed the lines which have put men to work and inspired the confidence of the dental practitioners in the usefulness of the electric current for other processes, such as implantation and sterilization, as well as the applicability of the Röntgen rays.

His words seem to have borne fruit, if one is to judge from the numerous electrical appliances exhibited at the twenty-eighth annual convention of the New Jersey State Dental Society, held at Asbury Park, July 20, 21 and 22, and described in another column. The members of this society deserve special mention for their early recognition of the value of the electric current for dental surgery by their papers and earnest discussions of subjects relating to electro-dentistry. But while several of these men have worked quietly, successfully and conscientiously, it must be admitted that the dental profession in general are still keeping somewhat shy of electricity for fear that they may not apply it properly. This has naturally restricted progress for the past year or two. The remedy for this unfortunate state of affairs must be found in embodying in the curriculums of our colleges of dentistry a thorough course in electro-dentistry, a correct understanding of the laws of application of electricity to dental surgery, a willingness on the part of practicing dentists to adopt the new methods, and the co-operation of manufacturers and practitioners to produce the most convenient and useful apparatus for their application. That this latter fact is being accomplished was evidenced by the numerous apparatus exhibited at the convention by various firms.

Regarding Röntgen rays it should be said that they have be-

Digitized by Google

come of great value to dentists, as by their means a permanent image of the teeth, gums and jaw can be obtained, depending upon the difference in the transparency of these parts to the rays. By their means not alone can an outline of the teeth be obtained, and the connection of their roots with the jaw, but also the canals, relative location of fillings and an outline of the gums. The use of the electric current for dental purposes seems to be nearly limitless, for, as Mr. Guy pointed out two years ago, among many other applications, "any drug that has been previously used without electricity within the mouth to produce specific effect, may now be electrically used with tenfold its former power for good." And thus we see a very fruitful field still open for thoughtful work, one which must be productive of a great deal of good to the dental profession in particular and suffering humanity in general.

Current Density as a Factor in Copper Refining.

THE recollection of the mystery which surrounded the electrolytic copper refining industry, as it existed fifteen or twenty years ago, may now well raise a smile among those who in these days handle thousands of tons of copper matte monthly. The secret of success was supposed to rest safely with a few German establishments, and with one well known gold and silver refining concern in this country. Of course there was no secret in the real sense of the word; but, nevertheless, besides this supposed barrier, there were substantial deterrents to the undertaking of electrolytic refining work and principal among these was the great cost of the plant and particularly the long period of time during which a large stock of metal remains unproductive of interest while undergoing the process.

It is perhaps to the great reduction in the latter item that the notable increase in electrolytic metal refining work is attributable. This is well brought out in a very able review of the situation by Mr. Titus Ulke appearing in the "Engineering and Mining Journal." It was not at all uncommon ten years ago for copper refiners to stock their tanks with 75 to 100 times as much copper as was daily produced in regular work. This enormous disparity has been gradually reduced so that to-day only from one-fourth to one-fifth that amount is required, or an average of 15 to 20 tons per ton of output.

For the ultimate cause of this marked improvement we must look to the method of handling the baths and especially to the higher current densities now made practicable. Whereas formerly currents of only 2 to 4 amperes per square foot were thought permissible, to-day current densities of from 15 to 20 amperes are employed in some establishments, and the end is not yet in sight.

The conclusion reached by Mr. Ulke is that the average proportion between the total copper "in process of treatment" and the yearly capacity (measured by output) of our electrolytic copper works is now about 4 per cent. as against two or three times as much formerly, and that the average proportion is going to decline still lower within the next year or two. These are interesting developments, and it is safe to say that with the water powers now being rapidly developed in the United States we shall see still further increases in the electrical metal refining industries.

Municipal Street Railways at Glasgow.

IT will be remembered that, until it was hunted to earth and killed, a very absurd statement was in general circulation in this country to the effect that Glasgow was able to do without local taxation, to pay salaries of all local officials, because of the profits from its municipal street railways. Anything more preposterous it would be hard to conceive, but the story was swallowed bodily by all sorts of municipalists here and was also used everywhere as an argument for municipal ownership. We pointed out at the time, how ridiculous the whole business was; various street railway officials here investigated and exposed the fallacy; and at last the city authorities came out with an unqualified official denial, on account of the innumerable inquiries they were receiving on the subject.

We have now the last Glasgow city tramway figures before us, and are forced once again to smile at the hugeness of the joke that could attribute to such a system the possibility of earning profit enough to pay the salaries of all the officials of the second city in the United Kingdom. The system carried only 106,000,000 passengers, and 35 per cent. of these paid only one-cent fares, for the shortest ride. The gross receipts were only $1,946,080, and the profit is put down at slightly over $500,000. Off this profit, however, comes $305,000 for charges, leaving only $200,000 for permanent way renewal and general reserve fund. This is not all, however. The city has 4,267 car horses and 385 horse cars, but should it adopt mechanical traction, as proposed, that investment would have to be written off at a terrible depreciation, as we all know who have witnessed the change in this country. Thus, as London "Engineering" remarks in its review of the balance sheet: "The balance of £100,000 of revenue over working expenses is more or less illusory." Of course it is; and the further statement is not less sensible: "It can scarcely be held that the tramways have yielded a substantial profit to the city as yet." It must be borne in mind, however, that, according to the London "Chronicle," the policy of the tramway department "is not to accumulate profits in aid of the rates, but to build up a fine service, both cheap and efficient." At present, we can say from personal experience and observation, the service is neither cheap nor efficient. One-cent fares for short runs prove nothing, and the population of Glasgow, lacking such a service as our large corporations give, enabling a person to travel ten and fifteen miles comfortably in fine cars for five cents, remains one of the most congested on the face of the earth. Incidentally we note that the city is pushing its municipal socialism a bit further by building its own cars. Why doesn't it build its own engine and dynamos? Why not make its own rails?

Presentation to the Volunteer Engineer Corps.

THE Engineers' Club, of this city, has offered to the first of the three regiments of Volunteer Engineers, under Col. Eugene Griffin, a stand of colors, to be paid for out of the club's treasury at an approximate cost of $500. The offer has been accepted with warm appreciation, and has led to so many expressions of approval and interest that it is now proposed to make this episode a general engineering function of interest to all the technical societies, the presidents of three of which have expressed their cordial co-operation. The idea now is to present the brigade of three regiments at least one portable searchlight equipment for use on the battlefield and in general work in relieving the wounded, bridge building, road making, etc. Such an equipment, in self contained units will cost about $3,000, and is a thing for which no Government appropriation is available.

Subscriptions will now be received in any amounts, from $1 up; and we hope the response from electrical engineers will be large, in view of the fact that so many members of the profession are in the corps, and also that the apparatus is electrical in its nature. The subscriptions should be sent in immediately as the first regiment is likely to be ordered to the front at any moment. The committee, comprising President John Thomson and other members of the Engineers' Club, has its headquarters there, 374 Fifth avenue, this city, and Mr. S. W. Baldwin is treasurer of the fund. We join with the committee in the wish that "a sum will be realized which will enable it to give fitting expression by material evidence, that the good will and moral force of the non-combatant engineers of America follow their active representatives at the front."

The Age of Automobiles.

IT will be noted that a respectable portion of our space is this week, and from time to time, occupied by articles and data relating to automobiles. This is but a sign of the slow, steady advance of the subject into the arena of practical technics, and of the coming supremacy of electrical vehicles for the major part of the work. But we do seem a trifle behind date in this country, when the fact is noted that at the recent exhibition in Paris no fewer than 750 automobile vehicles of the carriage type were shown, and that of these 120 were of the light chaise type. It may be questioned whether 150 carriages all told, have yet been built here. This may not be altogether a misfortune, for there are indications that the manufacturers, who come chiefly from the bicycle field, are rapidly settling down to electricity to the exclusion of other motive powers; and that the latest types of carriages built here compare more than favorably with those put forward as the best examples of the automobile art as practiced abroad. We are told, as an illustration of the situation in France, that a recent parade along the streets of Paris left the thoroughfares in need of purification, while many of the spectators were driven away by the stench of the petroleum. France has given its efforts chiefly to oil carriages, but may not have much to show for its pains after all, when the automobile industry at last gets down to its permanent basis.

Digitized by Google

ELECTRIC LIGHTING.

New Lamps of the Sterling Arc Lamp Co.

IN the construction of modern arc lamps, no features necessitate such important consideration as simplicity of design and operation. The lamp therefore that most perfectly represents this ideal must be acknowledged the acme of arc lamp construction. This is the claim made by the Sterling Arc Lamp Company for their so-called "universal mechanism," it being, with slight detail modifications, the same in all their lamps, whether employed for alternating, direct multiple, series or railway circuits.

In a recent visit which we paid to the company's shop, their general sales manager, Mr. R. J. Randolph, very interestingly described to us some of the novel features of the Sterling lamp.

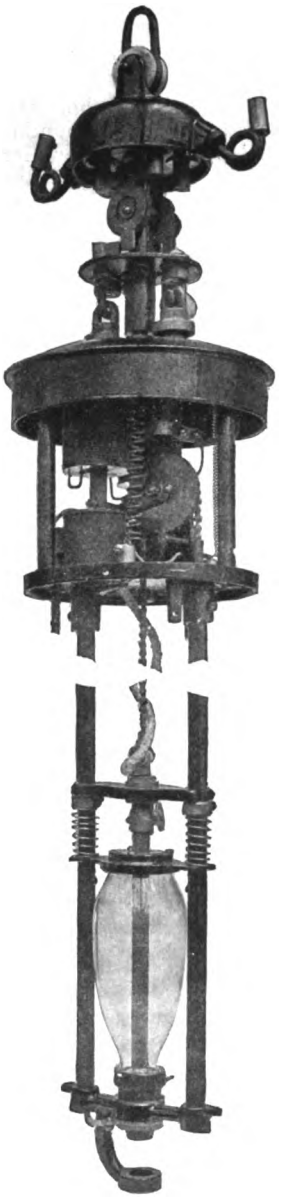
The regulating mechanism is of a new clutch chain feed type. The upper carbon holder consists of a cross-bar sliding between the two frame rods, with a carbon clamp centrally attached. Immediately above, the feed chain is connected and passes thence over the toothed clutch pulley in the mechanism. The chain is kept taut by means of a small weight attached to the other end and moving in one of the hollow frame rods.

In renewing the carbons, it is simply necessary to unscrew the outer globe-holding cup at the bottom of the lower carbon holder, and then, by loosening the screws of the upper and lower clamps, the carbons are readily passed through the hollow lower holder, and new carbons inserted without removing or in any way disturbing the globe. The upper carbon is also readily removable owing to the flexible feed chain support. This chain is not used for current carrying, but a separate conductor serves for this purpose.

The movement of the feed chain and its attached upper carbon is controlled by the previously mentioned clutch pulley over which the chain passes. This pulley is suitably pivoted in a projection from the mechanism base, and the control magnet operates on a pivoted clutch or brake bar causing the chain pulley to be gripped by the clutch member, turned the necessary distance, and carrying the carbon correspondingly. This clutch pulley is practically the complete regulating mechanism in all of the Sterling lamps. The inner globe is supported in a cup-like metal holder, fastened to the lower end of the frame rods. This support also serves as the clamp for the lower carbon. The inner globe is simply set in the holder and held in position by means of a cross-bar and cap, sliding between the two frame rods, and suitably held down upon the top of the enclosing globe, so that the latter is firmly and securely clamped in position, but can easily be removed by simply raising this cap-bar. In the construction of the globe cap forming part of this bar no moving parts whatever are used. It is claimed that owing to the construction of the upper sliding-bar carbon holder, perfect alignment is always maintained without the use of auxiliary mechanism in the globe cap.

D. C. Cons. Pot. Lamp.

Alternating Enclosed Lamp.



Cons. Cur. Series Lamp.

Style. D.

FIGS. 1, 2, 3 AND 4.—NEW STERLING ARC LAMPS.

THE CONSTANT POTENTIAL LAMP burns singly on 110-120 volt circuits, using about 4½ to 5 amperes and 80 volts. The clutch mechanism consists of a chain brake around the feed chain pulley, and is attached to the operating bar, so that movement is imparted to both ends of the chain when the bar is actuated. This clutch or brake chain operates as a bank brake with both ends movable. By means of this arrangement it is insisted no motion whatever of the regulating cores is lost, as the slightest movement of the latter

Digitized by Google

grips the feed chain pulley and any further movement is imparted to the carbons. The lamp is adjusted by means of a stop pin regulating the movement of the brake chain bar. No springs are used.

THE STERLING ALTERNATING LAMP burns singly on 100-120 volts at 60 or 125 cycles frequency, using 6 amperes and about 70 volts, and burns from 80 to 100 hours with one trimming. One of the claims made for this lamp is that it consumes only 425-450 watts. A regulating reactive coil on the lamp is so arranged, that by changing the connections on the coil the lamp may be adjusted to any frequency and voltage. The regulating coils are double series, connected with reactive coil, and acting on double laminated iron cores attached to the bar. Coil spools and other metal parts adjacent to the coils are of non-metallic material. The switch for opening the circuit is on top of the lamp.

The clutch mechanism is the same as in the constant current series lamp, it being claimed that by reason of the particular delicacy of this mechanism and the absence of lost motion, the carbons are fed together without the usual jump and burn without flicker.

What appears to be a decided departure and novelty is that embodied in the Sterling enclosed series lamp. While the mechanism is substantially the same as that already described, the clutch wheel parts are slightly modified to meet the extremely hard usage to which this class of lamps is at times subjected. The feed chain wheel is clutched by a novel form of clutch device, which works similarly to the double acting chain brake already described. The regulating mechanism is differential, consisting of series and shunt double coils acting on solid cores connected to the clutch bar.

The cutout is operated by the end of the clutch bar when the carbons are all fed. This cutout switch seems to be particularly substantial, being, in fact, a well made double pole knife switch, cutting in a low resistance loop around the lamp terminals.

No springs are used for adjustment, the lamps being regulated by means of a stop pin as in the multiple lamps. The lamp switch or line cutout is a decidedly new feature which is claimed to possess advantages found in no other similar device, as it altogether eliminates all possibility of danger to the lamp trimmer. This switch is in a separate case, which is hung from the supporting hook, and consists of a double centrally pivoted knife blade switch operated by a suitable handle, so that the lamp is entirely disconnected from the line and the current is not shunted through the lamp. The line wire enters this switch box, being properly looped, and the terminals from the switch to the lamps project through the bottom of the switch base in the form of two heavy insulated brass hooks.

On top of the lamp hood are two corresponding hooks, and to connect the lamp to the terminals from the line projecting through the switch base it is simply necessary to engage the hooks on the lamp with those from the bottom of the switch box. This is done by a rotary movement, and to facilitate this operation, and also to prevent any swinging of the lamp and to hold the hooks firmly together, a centrally placed pin from the top of the lamp hood enters an aperture in a projected stud from the switch box base. This pin serves both as a pivot and a steadying pin or bolt. Many advantages are claimed for this "hanger cutout," as it is called to distinguish it from the ordinary cutout boards.

The company also makes an open air series lamp similar to the foregoing. The power and railway circuit lamps employ the differentially controlled mechanism as in the series constant current lamps. They burn two in series on 220 volts, and five in series on 500 volts, taking 4½ to 5 amperes. Resistance is provided on top of each lamp, or one resistance in a fireproof box for the entire group.

A distinctive feature of the lamp is that all parts of the mechanism are either enamelled, nickeled or japanned.

The company is now placing its agencies throughout the country, a number of very desirable territories having recently been allotted in the West.

FARGO, DAK. Gen. Hughes and Sons have accepted the electric light franchise recently granted them by the city council over the mayor's veto, and having secured a site along the Northern Pacific right of way will have their plant in operation by the end of September.

SOCIETY & CLUB NOTES

Electricity at the 28th Annual Meeting of the New Jersey State Dental Society, at Asbury Park, N. J.

THE twenty-eighth annual convention of the New Jersey State Dental Society was held July 20, 21 and 22 at Asbury Park, N. J. Although the attendance of members of this thriving and influential body was somewhat affected—as so many conventions have been this season—by war conditions, some excellent papers were read, and preparations were made for a year of special activity. There was an exhibition of dental specialties, many of which were electrical.

The S. S. White Dental Mfg. Co., 1 Union Square, New York, had, as usual, a comprehensive and effective exhibit. One of its popular features was a motor stand outfit designed for use on the 110-volt direct current. It can be used on circuits having voltages from 100 to 120, or on a 220-volt power circuit with an extra special reducing resistance. It is not intended for employment with alternating current, primary or secondary batteries. It meets the needs of dentists by providing an efficient, compact, and convenient apparatus of a wide range of adaptability. The apparatus consists of the S. S. White dental motor, No. 2, an iron stand with a mahogany top, supporting a fireproof, speed regulating resistance in an iron case, and an electro magnetic clutch on a countershaft, supported on front of the stand, and a governing treadle connected to it by cable. The motor is enclosed in a glass case to protect it from dust, and the stand is mounted on wheels to facilitate its ready movement from one position to another. The special motor with this outfit has an extra pair of brushes, and collecting rings for use with transformer. The new S. S. White transformer, which is connected with the motor outfit, or to a special treadle rheostat outfit, furnishes a low-volt alternating current for operating electric mallet, mouth-lamp, hot-air syringe and cautery. The transformer, wall-switch, fuse plugs and connecting plate are enclosed in a mahogany case, 7¼ inches wide, 13⅜ inches high, and 6⅜ inches deep, which is fastened to the wall near the chair of the operator. When the door is closed, the apparatus is out of sight, and therefore cannot be tampered with.

About two years ago dentists began to take a great interest in the question of cataphoresis, and since that time the leading firms of electro-dental manufacture have devoted much attention to the devising of suitable instruments for cataphoric work. The cataphoric outfit found in this exhibit contains some excellent points. The controller consists of a polished wood cylindrical case with black enameled slate top, 5½ inches in diameter and 1½ inches high. The regulating wheel is raised above this 1 inch. Four cone-socket connecting posts receive the cords from the battery and electrodes, and a switch on the side of the case cuts off the entire current. The regulating wheel is 2⅜ inches in diameter, and contains the scale protected by a crystal cover. The apparatus is well under control and the adjustment is exceedingly accurate.

This firm have also bestowed particular care on the construction of mouth lamps for dental work. One form of lamp they exhibited is highly recommended by dentists. It lights up the teeth and gums so strongly that any cavity of decay or unsuspected dead pulp, or even the slightest thickening of the tissues, which is precursor of decay, is unerringly detected. Illumined by this lamp, while sound teeth will appear translucent without variations in texture, a dead tooth will be opaque, even when its color gives no indication to ordinary observation; and a cavity of decay of any foreign substance will show as plainly as a spot on a window pane. For the examination of posterior cavities a mirror is attached to the guard in front of the lamp globe. These outfits are supplemented by a cataphoric galvanoscope made especially for the use of dentists, Weston milliamperemeter, etc.

H. H. Johnson, representing the Dow Portable Electric Assistant, showed some samples of that useful outfit. One was an oak case containing three cells for use where light is only required. It was fitted with one lamp, one direct reflector, one side

Digitized by Google

reflector, one tongue depressor and one mirror. Another set had an otoscope for use in the examination of the eye and ear, a cautery suitable for light cautery work, an electro magnet for the removal of iron or steel from the eye or any part of the body; a probe and sounder for finding metals embedded in the body; an electric needle for cataphoresis and electrolysis; and a head light and band for use in connection with the cystoscope and urethascope. Another set contained a complete cataphoric outfit for dentsts with light and reflector, and a perfectly regulated rheostat, which enables the operator to control the current perfectly. These outfits were highly spoken of at the convention.

Very effective use of the Lundell motor is made in the electric dental engines exhibited by John F. Hammond, 25 East 125th street, New York. These engines are very complete and show wonderful adaptability of control. The special feature of the outfit is the foot switch, by which it is possible to control both the speed and direction of the motion absolutely. The foot piece is hung on a central pivot, and the speed is regulated by steps. The regulation goes evenly in five gradations, from zero to a speed of 3,600 revolutions. Either battery or street current can be used. A new departure in this outfit is the Wappler controller, the resistance of which is a continuous coil of specially prepared carbonized wire, the regulation of which is effected by a pole running across the side, which can be easily moved backwards or forwards by the hands.

Among other exhibits was a two cell storage battery for dentists exhibited by the Ritter Dental Mfg. Co., of 563 North St. Paul street, Rochester, N. Y., which presented many points of excellence. This firm also showed an electrical dental engine for 110-volt circuits, an electrical engine for four volt battery circuit, laboratory lathes, cataphoric appliances, etc.

The electrical specialty of the Consolidated Dental Mfg. Co., of 115 West Forty-second street, New York City, was a dental hammer embodying new principles, and actuated by six cells of Partrick & Carter's dry battery. This company was represented by Dr. Barnes.

Another form of electro-magnetic dental mallet was exhibited by its manufacturers, the Russell Electric Mallet Co., of Morovia, Md., as well as a number of electro dental specialties.

An interesting collection of electro dental and surgical appliances was shown by Louis Costa, Jr., & Co., of 1225 Callowhill street, Philadelphia, Pa. The cataphoric volt selector of this firm is commended. One of the special features of this exhibit was the Cox thermopile, which is now being used to a considerable extent by dentists, and in connection with which Messrs. Costa, Jr., & Co., mentioned some promising results.

The Burnham Electric Company, 146 Franklin street, Boston, Mass., showed an improved gravity battery—the Excello—which excited much interest. This firm is receiving ample recognition in its efforts to manufacture the best possible forms of existing dental appliances, while working up a line of electrical specialties.

Other exhibitors of electrical devices were B. & E. Hanfeld representing the Waite & Bartlett Mfg. Co., of New York; the Dental Protective Supply Co., of Chicago, and the Edison Mfg. Co., of St. James Building, New York, whose fine specialties and apparatus available for dental and electro medical work have already been illustrated and described in these columns.

THE STOCK MARKET

Steady but Sluggish.

THE course of events during the past week was sluggish, although the market was steady and conditions were such as favor a cheerful feeling. Of course it is midsummer, and there is nothing to worry the country except the war, and that seems likely to recoup us for all the anxiety and expense bestowed on it. Crops look well, and the public belief is that fall trade will be excellent. News from the Klondike goes to show that the icebergs up there will yield $20,000,000 this season, which ought to leave some margin of profit. Now that the Cervera fleet has been snuffed out of existence, there is a brisk renewal of Atlantic coast and West Indian shipping trade and the outlook there is most encouraging for large business.

During the week, 5,202 shares of Western Union were sold from 92 to 92½; of General Electric, 2,880 from 38½ to 39¼. In Boston American Bell Telephone sold at 275. New York Edison is selling at 131½ and Brooklyn Edison at 122½.

The copper market appears fairly active. For Lake copper 11½ cents is asked. Heavy steel rail, Eastern mill, is $17.

LEGAL NOTES

Sterne vs. the Metropolitan Telephone and Telegraph Company and New York Telephone Company.

JUDGE KELLOGG in the New York Supreme Court handed down on July 18 two decisions in the suit of Simon Sterne against the New York Telephone Company, which practically leaves Mr. Sterne without any case against that company. It will be remembered that some years ago, when the Metropolitan Telephone Company reconstructed its system and made metallic circuit working the rule, Mr. Sterne refused to allow his telephone line and instruments to be changed to metallic circuit, and when the telephone company proceeded to act upon its right to terminate its contract with Mr. Sterne, the latter secured an injunction restraining the company from interrupting his telephone service, and brought suit to compel it to furnish him service at a rate to be fixed by the court. The injunction was continued pending the trial of the suit, the Metropolitan Company being authorized to change Mr. Sterne's line and instruments to metallic circuit, and he giving a bond to pay the full rate in the event of the case going against him. The case was given considerable space in the newspapers.

Some time later the Metropolitan Telephone and Telegraph Company went out of business and sold its plant to the New York Telephone Company, a concern organized to furnish telephone service in a much larger area than that served by the Metropolitan Company. Mr. Sterne subsequently secured an order to bring in the New York Telephone Company as defendant, and it was to that company's motion to vacate the order that one of Judge Kellogg's decisions referred. The decision states that this was the first opportunity the New York Telephone Company had to be heard in the matter, and that company had the right to expect that its present motion would be considered unprejudiced by any previous determination of the court had in its absence. "The order and the supplemental complaint obviously regard this defendant as a corporate body separate and distinct from the other defendant. It is not the same body under a new name or changed name. It must be regarded as having no legal relations with the other defendant or with the acts of the other defendant except those created by contract with it." The decision points out that while Mr. Sterne alleged that the New York Telephone Company assumed all "debts, contracts and liabilities" binding upon the Metropolitan Company, it is not alleged that there existed any contract with Sterne binding upon the Metropolitan Company. Even construing "liabilities" as the alleged legal liability to furnish telephone service to the plaintiff, the case is no stronger "for one cannot make more binding his burden by declaring upon paper his intention to perform what the law directs. In no way can it be reasoned that this is a contract liability. If this defendant owes any duty to the plaintiff, it is because the law imposes it." After stating that there is no precedent in support of any other contention, the opinion concludes as follows: "The law does not hold this defendant responsible for any alleged wrongful threats of the Metropolitan Telephone and Telegraph Company. That is the cause which enabled plaintiff to bring this action in a court of equity. The cause of action does not in law follow the property; the duty to furnish the service may, when a similar case arises against the new owners, it may be held to answer, but I see no ground whatever for the contention that it must answer for the threats of its predecessor in ownership. The motion to vacate is therefore granted, with costs."

Digitized by Google

The second decision of Judge Kellogg relates to a motion to vacate an order permitting the examination of the officers and books of the Metropolitan Telephone Company to procure testimony, an order in which by a supplemental complaint it was sought to bring the New York Telephone Company as successors. The motion to vacate was granted for much the same reasons as those given in the previous opinion. The original defendant had gone out of business, and no issue remained between it and the plaintiff. There was no contract between them, and the defendant, therefore, could owe the plaintiff nothing, and did not seek to recover anything. The relief sought by the action was now impossible. The decision goes on: "By the supplemental complaint the plaintiff seeks to create a living issue with the defendant, the New York Telephone Company, to obtain a substantial judgment, viz.: The judgment he originally claimed against the Metropolitan Telephone and Telegraph Company, on the ground that it has succeeded to the property and duties of the last named company. The fact that plaintiff by order of the court deemed it necessary to bring in this party as a defendant is a sufficient admission that it has a separate entity and is to be treated as a separate and distinct party; as a new party it has a right to be heard on all motions affecting the trial and especially in motions to examine books and officers to procure testimony to be used at the trial. The order here sought to be vacated as to this defendant, is a nullity. The testimony procured under this order could not be read at the trial under any issue formed with the supplemental complaint, and for that reason in my judgment, the order should be vacated. If the Court of Equity will exercise the right to fix in advance the annual rentals of telephones at the instance of an individual desiring to have his premises equipped with these mechanical facilities, it will fix such rental on a basis of reasonable profits to the company or individual directed to render such service, and this necessarily involves an inquiry into the affairs and business of that particular company or individual. The books of any other company or individual are not competent evidence on such an inquiry, they are not admissions to the party, and possess no higher grade in testimony than hearsay. For such reason the testimony sought by this order, even though the order were made on notice, could not be made available as against the New York Telephone Company. I am of the opinion that the order should be vacated, with costs, and it is so directed."

Carty's Telephone Bridging Bell.

PATENT SUSTAINED—WESTERN ELECTRIC CO. vs. MILHEIM ELEC. TELEPHONE CO.

AN important decision has just been rendered in the U. S. Circuit Court of the Western District of Pennsylvania by Judge Buffington, sustaining the bridging bell patent issued to J. J. Carty, No. 449,106, of March 31, 1891. The litigation for infringement was between the above parties, and the defence was lack of novelty and of patentability. The decision sustains the patent.

Prior to this patent it was customary to connect the call bell magnets at the several stations in series in the main line circuit together with a normally shunted call sending generator and at each station to provide a switch, which, when at rest, maintained the continuity of the main circuit through all the call bell magnets and kept the circuit of the local transmitter battery open. When, however, the switch was changed—which was done when the receiver was taken from the hook for use—it disconnected or short circuited the bell magnet or generator from the line and introduced in place thereof the telephonic transmitting and receiving instruments and closed the local battery circuit of the former. Though this switch change at the two communicating stations removed the bell magnets at such stations from the circuit, no such action took place at the other stations. Consequently the voice current had to traverse all the other magnet helices in the line and was much weakened, not only by the resistance of such magnets, but also by the counter electromotive forces or inductive resistances developed in each. These were so active and energetic as to hinder conversation, yet it was necessary that all bell magnets should be connected with the circuit, otherwise the several stations cannot signal each other. It will be noted that in this system, which is called a series-circuit, the component parts are so arranged that the current must pass through all its parts, one after another. It is so styled in contradistinction to a multiple circuit, which is one having two or more of its parts so arranged that the current divides, portions of it passing through parallel paths afforded by the several parts. The two systems may be thus illustrated: When incandescent lights are connected in multiple circuit, the current passes to one terminal of each of the lamps which are connected to one side of a circuit and then divides up, a portion passing through each lamp to the other side of the circuit, where all these portions are reunited. Where such lamps are connected in series, all the current must flow into the terminal of the first lamp and out at the other, and so on through the successive lamps.

It also appeared impossible to obtain a perfect inductive balance in a metallic telephone circuit when the bell magnets and telephone were connected in series and such inductive disturbances manifested themselves generally in annoyances and sometimes were so intense as to prevent conversation. Now it would seem that if, instead of the series circuit connection for both call magnets and telephones, a multiple circuit or bridging connection after the manner of the simplest form of incandescent lighting was substituted these difficulties would be avoided, but the conditions were different since in a telephone circuit each station is both a generating and a utilizing one at the same time. Therefore the generating currents are likely to be short-circuited by the nearest bridge connection and thus fail to reach the more distant station which it is desired to signal. The additional fact that two diverse uses are to be made of the current at the same station, viz.: signaling and transmission of sound, and that they are to be used interchangeably between all the stations, renders necessary the addition of other means and factors to simple mere parallel arrangements. To overcome these difficulties the patentee suggested a simple and efficient remedy.

The Carty patent shows and describes a method of attaching telephone instruments in multiple between the two sides of a line, whether this line be a metallic circuit or a grounded line. The call bells are each permanently bridged between the two sides of the line and are made of high resistance and retardation. The generator at each instrument is in a separate bridge circuit which is normally open, but closed when the generator is operated. The telephonic apparatus proper is in a third bridge circuit, which, like the generator circuit, is normally open. The telephone circuit of each instrument is automatically closed when the receiver is removed from its hook for use, and this operation also closes a local circuit containing the primary of the induction coil, the local battery and the transmitter. In order that there shall not be an undue leakage of the voice currents through the permanently bridged call bell circuits, the magnets of these call bells are wound to a high resistance (usually a thousand ohms) and are also constructed in such a manner that they will have a high co-efficient of self-induction. When a generator at any one station is operated it is connected across the two sides of the line in parallel with all of the call bell magnets on the line. Part of the currents in this generator will, therefore, pass through each of the call bell magnets on the line, thus causing them all to operate if the amount of the current generated is sufficient to accomplish this result. The successful operation of this system depends on the fact that a coil possessing a high co-efficient of self-induction will transmit with comparative ease alternating or pulsating currents of low frequency, while it will form a practical barrier to similar currents having a very high frequency. The currents generated by the calling generator at any station are of sufficiently low frequency to pass with comparative ease through the call bell magnets arranged along the line, while the rapidly alternating voice currents impressed upon the line by the telephonic apparatus at any station will be compelled to pass over the main line to the receiving station without being materially weakened by leakage through the call bell magnets. At the receiving station these voice currents will pass through the telephone receiver and secondary coil of the induction coil, these being connected across the line at that station by virtue of the receiver being off its hook. This path through the receiving instrument is of comparatively low resistance and retardation and thus practically takes all of the current from the distant station.

Adopting this as a sufficient description of the device and its purpose, the court dismisses as not pertinent a number of alleged anticipations, including patents of Varley, Scribner and Van Rysselberghe.

CARD ELECTRIC CO. A receiver has been appointed for this company.

Digitized by Google

REPORTS OF COMPANIES

The Scaling Down of General Electric Capital.

A circular from President Coffin to the stockholders says: "Your directors are advised by counsel that in consequence of the impairment of its capital, the company is forbidden by the laws of New York to pay any dividend whatever until the amount of such impairment shall have been regained, or until the nominal or share capital stock shall have been reduced to the amount of the actual capital. Under existing New York law, the nominal or share capital of the company may be reduced at any time by a vote of a majority in interest of all the stockholders, and counsel advise that if any reduction be made the common and preferred shares must be reduced alike. In view of all the foregoing, your directors regard it their duty to urge the stockholders to make at once such reduction of the nominal or share capital as shall permit the payment of dividends upon both classes of stock with the least practicable delay. The consolidated balance sheet of the company of January 31, 1898 (being the close of the last fiscal year), appears in the last annual report of the company. Your directors, being of the opinion that the valuation at which patents, franchises and good will were carried in this balance sheet—namely, $8,000,000—was excessive, and that the fai and reasonable value of this item is the sum of $4,000,000, have by resolution directed this item to be reduced to that amount upon the books of the company, as of June 30, 1898. Taking into account the estimated earnings of the company to August 10, 1898, your directors believe that a reduction of the share capital of the company as of August 10, 1898, to sixty per cent. of its present amount would make the share capital of the company substantially equal to the amount of the net assets which will then be on hand over and above the debts and liabilities of the company. Any surplus net earnings from and after that date will then be applicable to the payment of accrued dividends on the preferred stock and future dividends on both classes of stock."

THE UNION TRACTION CO. of Philadelphia has converted the deficit of $851,900 in 1897 into a surplus of $24,600, showing a gain for the year of $876,500 under the management of Mr. Parsons.

TRADE NOTES AND NOVELTIES

Affairs of the Western Telephone Construction Co.

The Western Telephone Construction Company, of Chicago, is at present operating its factory night and day, employing something over two hundred hands. Since the reorganization of the company, its business has been largely increased. The shipments for the current month promise to be the largest in its history. During a period of forty-five days, dating from the 1st inst., thirty-two complete telephone exchange equipments will be shipped from its factory, including the central office equipment of over 2,000 stations capacity for the Newark Telephone Company, of Newark, N. J. This represents the most extraordinary output in the history of independent telephone manufacture.

Following the reorganization of this company, some differences arose between the stockholders, and thus certain persons have circulated reports of trouble in the Western Company, some going even so far as to make the statement that a receiver had been appointed.

The facts are that the company's officers are in entire harmony, and its financial and business condition is far more substantial than at any time in the past, while its responsibility and reliability have considerably increased of late. The present volume of business with which it is favored, calling for overtime work in the manufacturing department, although the company has recently increased its manufacturing capacity, will certainly tend to create confidence in the present and prospective prosperity of the concern. Its officers positively state that its financial resources, as shown by its balance sheets, much exceed in net value the total amount of its capital stock under its present capitalization, and the success of the company should be a matter of congratulation on the part of the independent telephone users of this country whose interests it has so vigorously and conscientiously promoted.

Multiphase Cable and Lower Fire Insurance Rates.

As already reported, the Suburban Underwriters' Association, on June 28, increased the rebate allowed for the Auxiliary Fire Alarm System to 10 per cent., when the boxes are connected by "multiphase" wire, so that the system becomes automatic, as well as manual.

The value of automatic connection with public fire alarms has been for many years, says "The Insurance Press," universally recognized by the underwriters, and encouraged by liberal rebate allowances. Thus far the only systems of public automatic alarms connecting with public fire departments are operated through their own central stations, as fire departments do not allow the thermostats in general use to be connected with the street boxes. The expense of wiring and the cost of central office maintenance are so great that the thermostatic alarm business cannot be made profitable outside of the very large cities, and even in them is never extended into the outlying districts, where protection of this kind is greatly needed. The value of thermostatic alarms, as shown by experience of many years with the central office system, proves the immense importance as a factor in reducing fire losses of a practicable system of automatic alarms which can be operated outside of the comparatively narrow limits of the central office thermostatic system. This extension has now become not only possible, but practicable, and is to be at once brought into use. The auxiliary system, as already well known, has for years rendered service of very great value, by providing means for operating street boxes from the interiors of buildings. In every one of the cities where the auxiliary alarm is used it has saved many times the rebates which have been allowed by the underwriters.

Still, manifestly, its usefulness would be greatly enhanced if alarms could be sent in from an auxiliary equipment, at a time when the premises are unoccupied and unwatched. It has never been a matter of any mechanical or electrical difficulty to connect ordinary thermostats so as to operate in the same circuit with the auxiliary boxes, but the danger of unnecessary alarms has prohibited this. The recent invention of the "multiphase" cable has been adapted for use in connection with the auxiliary system, so that this becomes also automatic without the sacrifice of any of the peculiar features of safety from false alarms, which is the foundation of the willingness of fire department officials to allow its connection with street boxes. The combined system also is like the auxiliary system itself, always under automatic test, so that any disarrangement of the wires or batteries is instantly made known. When an auxiliary equipment is installed with the multiphase wire the auxiliary boxes located on each floor will be connected by these wires, which will be run through every room in the places where it would seem most likely for a fire to occur, and especially into dry rooms, storage rooms for inflammable materials, and generally through whatever mav be regarded as the danger points in each case.

Whenever the smallest flame reaches any inch of this wire the alarm is instantly transmitted to headquarters as if the street alarm box had been operated by hand. Every foot of this "multiphase" wire when thus installed becomes an ever-vigilant watchman, ready when needed to instantly transmit a fire alarm to department headquarters. Through this combination of the auxiliary system and the multiphase cable a new and most important advance in fire alarm telegraphy has been made. It is now possible to make an incipient fire send in its own alarm to fire headquarters in every city or town in the United States which has a public fire alarm telegraph. The managers of the auxiliary automatic alarms do not intend to come into competi-

Digitized by Google

tion with the established thermostatic central offices, but in furnishing automatic alarm facilities in the vastly larger territory in which the central office systems, for reasons stated, have never operated, they will inaugurate a new era of improvement in fire alarm telegraph facilities which will doubtless be as readily welcomed by all underwriters as it has been by the Suburban Association.

The Burton Electric Welding, Forging and Brazing Machine.

AFTER years of experimenting with numerous welding devices and machines for electrically forging and brazing metals, the Burton Electric Smelting Co., of Boston, Mass., have succeeded in producing an outfit which is claimed to meet all the requirements of modern practice. The complete installation which is shown in Fig. 1 is composed of the generating ap-

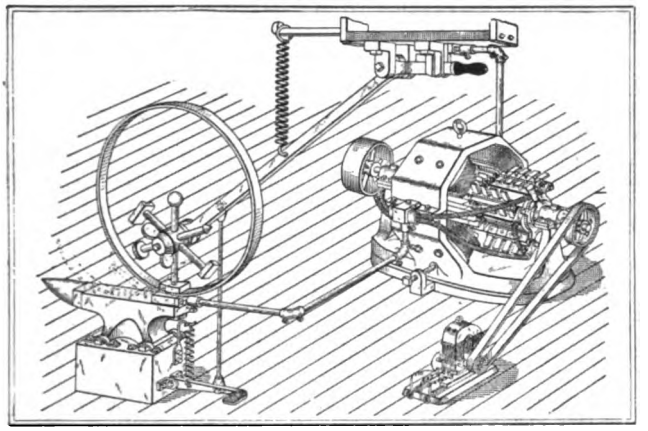
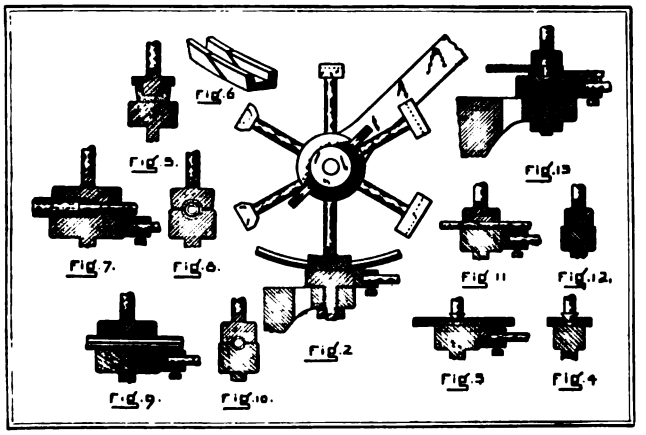


FIG. 1.—BURTON ELECTRIC SMELTING CO.'S DIRECT TRANSVERSE CURRENT WELDING, FORGING AND BRAZING MACHINE.

paratus, the controlling devices, the transmission parts, the anvil electrodes and means for applying the mechanical pressure and current. The machine makes a lap weld without injury to the metal, and it is well known that a lap weld is superior to a butt weld. The operation is performed on the anvil in view of the workman. The piece to be heated or welded rests on the electrode block connected with the anvil. By depressing the foot lever the revolving electrode is brought into contact with the metal and the heating effect takes place. As soon as the re-



ELECTRODES FOR BURTON ELECTRIC WELDING, FORGING AND BRAZING MACHINE, AND ATTACHMENTS FOR SPECIAL WORK.

quired heat is obtained the foot lever is released and the weld completed by hammer blows on the anvil.

In Figs. 2 to 13 inclusive are shown various types of electrodes for different kinds of work in connection with the Burton Electric Smelting Company's direct transverse current welding, forging and brazing machine.

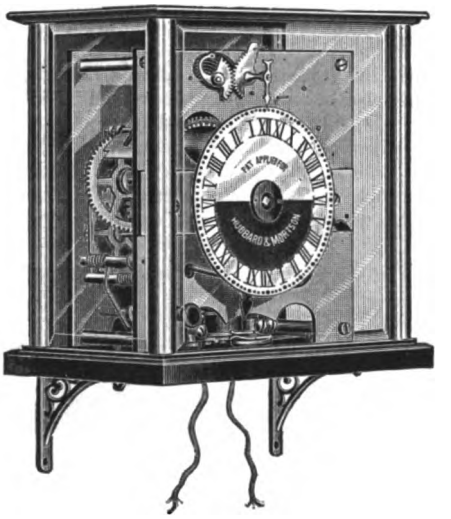
ADAMS-BAGNALL ELECTRIC CO., of Grand Rapids, Mich., has been incorporated with a capital stock of $225,000.

The Hubbard-Mortson Automatic Time Switch for Turning off and on Electric Currents.

FROM time to time several cumbersome and more or less clumsy applicances for automatically turning off electric currents have been put upon the market. These have accomplished the one purpose of turning off the switch and a simple alarm clock movement has usually released a gravity contrivance whereby the cutout is accomplished. The automatic time switch clock illustrated herewith is claimed to be the first appliance that has ever accomplished the twofold movement of turning on and off the electric switch at any time of the day or night at which the clock may be set. This is without doubt one of the most important mechanical appliances for controlling electric circuits, and will be of interest to the electrician, engineer and every householder.

As may be seen from the illustration, the automatic time switch clock presents a handsome appearance. It looks like an elegant French clock with its polished movements, brass corner pillars and panels of plate glass enclosing the clock movement and switch train. The case is mounted upon a substantial base of slate upon which is placed an ordinary four-pole electric switch. The wires to be controlled are cut into this switch in the ordinary manner.

The operation of the time switch is exceedingly simple, but most practically and thoroughly effective. A twenty-four-hour dial, which makes one revolution every day, revolves under a fixed pointer at the top. At the back of this dial are supplied two movable pointers held in position, with sufficient friction, by a spring disc. These pointers may be set at any time of the night or day, and are fixed rigidly in position, when set, by pins which engage in a row of holes parallel with the circumference



HUBBARD & MORTSON AUTOMATIC TIME SWITCH FOR ELECTRIC CURRENTS.

of the disc. When the first pointer reaches the reading point at the top the other end trips an alarm wire which connects with the time hook and sets in motion the train which turns the switch. As time passes, the second pointer approaches the point of reading, reaches it and sets the train in motion again, accomplishing the second motion of the switch, and turning off the lights. Absolutely all the attention that this requires, after having been set for the hours desired, is winding once a week.

The time switch is used most practically and thoroughly for the controlling of electric lights in show windows, burglar alarms, arc light circuits, and, in fact, everywhere where electricity is used. Different sizes of switches are put into the clock in accordance with the strength of the current it is required to handle. The mechanism is well made and the clock train thoroughly reliable, having been manufactured under the personal supervision of Frank E. Hubbard, the well-known horological expert. The new time switch is meeting with the most hearty welcome from all electricians for its practical utility, its money saving qualities, and its great convenience. The switch arranged on a slate base meets all the requirements of the National Board of Underwriters. The Hubbard & Mortson factory, where the new time switch is made, is located at 42 Union place, Hartford, Conn.

Digitized by Google

Advance of the Storey Motor.

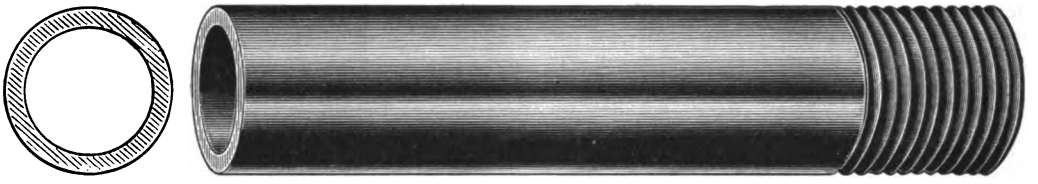
The Storey Motor & Tool Co. have moved their main office and factory from Philadelphia to 464 South Broad street, Trenton, N. J., in the plant with the Trenton Iron Co. This change is made necessary by the greatly increased demands for the electrical machinery of their manufacture, particularly their multipolar, entirely enclosed, dust and moisture-proof motors, the first of this style to be placed on the market, several years ago.

The motors at present manufactured by them have been improved both mechanically and electrically, all advantages having been taken from years of past experience, the machines being second to none and having some features possessed by no others, together with light weight, high efficiency, slow speeds and special form which makes them particularly adapted to all classes of direct connected, machine tool, hoist, crane, mill, mine, and, in fact, any variety of combination.

With their increased facilities the company will also put on the market their open type machines for all classes of standard work, together with several lines of specialties which up to the present time they have been unable to push. Within a short time the company expects to have everything running in proper order, and will be pleased to hear from any of its old customers or give any details and descriptive matter regarding its machines to any parties wishing information.

Safety Conduit Company, Pittsburg—The "Loricated."

THE advent on the market of the products of this firm, which are known as "Loricated" electric conduits, marks a decided step in advance in the line of safety appliances for the protection of interior electric wiring. The conduit proper consists of ordinary steel tubing like gas pipe, made in ten-foot sections, threaded at both ends, and provided with suitable couplings, but which has undergone a sort of japanning process, by means of which the tubing has received a tough, smooth "Loricated" covering, both outside and in, and which is so constituted that it will not crack in bending, while it resists perfectly the action of moisture, of acids and alkalies. The interior is left smooth as glass, which facilitates the insertion or extraction of the wires, without the use of soapstone or any other lubricant. T's, elbows and curved angles are also provided, but are not always necessary, owing to the facility with which the tubing can be bent. When in place, it furnishes a safe armor for the wire, so that it cannot be injured by nails or receive any mechanical injury, while they are entirely protected from any accumulation of moisture. These conduits are also especially adapted for the protection of wires in mines and in mills where there is an excess of moisture, like paper mills, or buildings devoted to chemical processes where the vapors contain injurious acids. The products of the company have been tested and approved by the experts of the National Board of Fire Underwriters and by many local boards, and wherever installed they have given satisfaction both to inspectors and to workmen, who are said to like them on account of the ease with which they are installed, and because by reason of being able to bend the tube around corners, a much better job can usually be made than where elbows are employed. This feature also renders the cost of labor in installing comparatively low.



THE "LORICATED" SAFETY CONDUIT.

The company not only manufacture piping for interior construction, but also "Loricated" soil and vent pipes. This product consists of the ordinary castiron sewer pipe, which has been treated in the manner described above. This prevents the action of electrolysis, and gives a smooth interior surface which facilitates the passage of the sediment to the sewer outlet. It results in lasting qualities equal to those of terra cotta pipe, and more healthful from a sanitary point of view, because the joints can be lead caulked and thus prevent the possible escape of foul gases.

Another use to which "Loricated" pipe is put is for water service pipes, and especially in places where sulphur and acids abound, the coating on the pipe being found to resist the effects of all sulphurous acids, alkalies, etc. It might also be mentioned that any ordinary engineer or pipe fitter can install such pipe, for the reason that what is used for this particular purpose is ordinary gas pipe of standard dimensions, thread, etc. In the process of manufacture all rust, scale and other obstacles are removed from the tubing, after which the "loricating" compound is applied. The process is the result of eighteen years of experimenting by the superintendent of the works, and is exclusively owned by this company.

The works are located at Rankin Station, about eight miles from Pittsburg, on the line of the Baltimore & Ohio, and Pittsburg & Lake Erie Railways, both of which provide free switching facilities for the delivery and shipment of material. The tubing is purchased in carload lots from the neighboring pipe mills, and a large stock is always kept on hand.

The works consist of a number of substantial brick buildings, with a two story isolated building for office purposes. The equipment is ample for promptly turning out large orders, one of the largest of which, that was recently supplied, being for 150,000 feet for the new Washington post-office. Other large recent orders include the full equipment of the new Studebaker Building in Chicago, and the Prudential Building at Atlanta, Ga.

Orders for Sterling Telephone Apparatus.

The possibility of securing central office equipment similar to that used by the Bell companies seems to have an allurement for the independent telephone companies. They believe that what is good enough for, and has been perfected in the Bell Company's use, by way of apparatus, is surely good enough for them. Acting upon this belief, the following companies have placed orders with the Sterling Electric Company, of Chicago, as follows: The Mutual Telephone Company, of Des Moines, Iowa, 2,000 drop standard metallic circuit board; Lafayette Harrison Telephone Company, Lafayette, Ind., the equipment complete for a 1,000 drop exchange. This consists of switchboards, cable terminals and protectors and distributing boards. The Plymouth Telephone Company, of Plymouth, Ind., 200 drops metallic circuit board; the Schance & Fair Electric Company, of Chrisman, Ill., 100 drops of standard metallic circuit board. This apparatus when installed will it is claimed give the independent companies the same central office equipment as the Bell Company are using.

Westinghouse Air-Brake Prosperity.

Mr. George Westinghouse, Jr., takes highest rank among the princes of invention and finance. At the recent meeting of the stockholders of the Westinghouse Air-Brake Co. it was decided to increase the capital stock from $5,000,000 to $11,000,000 by distributing 100,000 shares at a par of $5,000,000, to stockholders as a stock dividend, and to hold the remaining 20,000 shares of a par of $1,000,000 in the treasury for the purchase of property. During the last fiscal year the company has paid its stockholders four regular and four special dividends amounting to 50 per cent. cash, and the present dividend of 100 per cent. makes the earnings and distribution unprecedented in the history of Pittsburg concerns. The net earnings of the company in ten years have been $17,500,000, while the cash dividends have amounted to $14,596,000.

COLUMBUS, O. The City Council has voted down, after investigation, a scheme to install a municipal telephone plant.

Digitized by Google

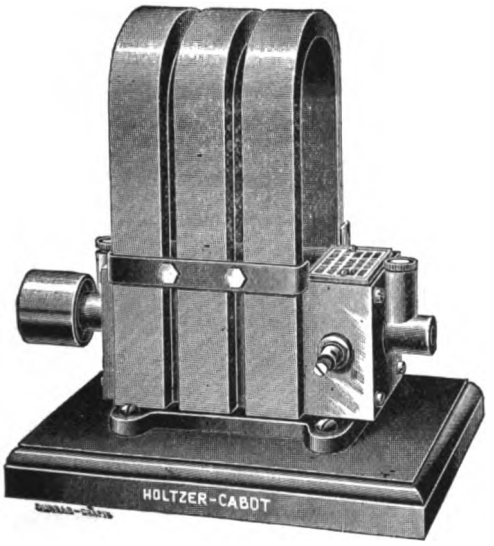
Mr. Paul Hoenack.

For twenty years and more, Mr. Paul Hoenack, of 191 Worth street, has been prominently identified with the development of electrical devices of all kinds. In that period, he has exercised his skill as a mechanician in every branch of the science and has worked for almost every electrician of note in this country and for many abroad. Apparatus made by him is to be found in telegraph and telephone centres, in submarine cable stations all over the world, in colleges and private laboratories, in the army and navy, in electric light and power stations. Indeed, the name of "Hoenack" can be seen stamped on instruments of many kinds wherever the pulse of civilization throbs through an electric circuit. It gives us great pleasure to be able to utter these words of well deserved commendation for one who has done so much for the profession and whose talents and skill have contributed no little to making practical many important inventions which are benefiting mankind at the present day, and some of which, perhaps, would never have been perfected without his assistance.

To all inventors struggling with difficult mechanical problems, or disheartened by incomplete or imperfect instruments, we heartily recommend Mr. Hoenack as competent to achieve for them whatever the highest mechanical skill and long varied experience can accomplish. Mr. Hoenack's factory and office are located at 191 and 193 Worth street, New York.

The Holtzer-Cabot Gas Engine Igniter.

ONE of the most satisfactory machines devised for igniting gas and gasoline engines has recently been placed on the market by the Holtzer-Cabot Electric Co., Brookline, Mass. The machine, illustrated herewith, is constructed with a permanent magnet field and an armature of the drum type, similar to that used in our direct current motors. It has self-feeding carbon brushes and is self-lubricating, being provided with grease cups. It is dirt, oil and moisture-proof. It can be run in either direction, and may be driven, if the fly-wheel of an engine



HOLTZER-CABOT GAS ENGINE IGNITER.

runs true, from a friction pulley bearing upon same, or may be belted to fly-wheel or any convenient shafting. The speed should be about 2,000, but it can be run at any speed, say 1,500 and 2,000 r. p. m. The battery, which may be 4 or 5 cells of any ordinary open circuit form, is used but for a few moments to start the engine, consequently will last indefinitely. The advantage of the dynamo over batteries for lighting gas in gasoline engines is apparent. It is well known that the strength of a battery current on this class of work rapidly gives out, the battery soon becomes exhausted, requiring frequent renewals of solution and zincs. Besides this, trouble often arises through the battery connections becoming corroded and opening the circuit. The dynamo, on the other hand, can be depended upon to give a constant current.

TELEPHONING from Manchester to Brussels, via London and Calais, has been tried with great success.

CATALOGUES.

Patterson, Gottfried & Hunter, Ltd.

The above well-known dealers in machinery, metals, hardware, tools and supplies, located at 146-150 Centre street, New York, have just issued a very complete catalogue, illustrating the numerous machines sold by that company. The Springfield-Muller engine lathes are described in detail, and their numerous advantages pointed out. There are further shown Springfield crank shapers, power presses, centering machines, hand milling machines, water tool grinders and a great variety of chucks, arbors, grinding and polishing machines, and patent countershafts. The catalogue will be sent to any one on application.

Chloride Accumulators.

The Electric Storage Battery Co., of Philadelphia, Pa., are sending out circular No. 42, which contains a description of the installation of chloride accumulators in the plant of the Claremont Electric Light Co., of Claremont, N. H. This plant is one of the most unique of its kind in this country and is exceptionally interesting, because it conclusively exemplifies the advantage of the application of storage batteries to small lighting installations. The pamphlet contains a complete description of the plant, and shows illustrations of the storage battery room, switchboard, switchboard connections and a view of the dam and power house.

Farr Telephone and Construction Co.

A very complete catalogue of telephones and telephone supplies has recently been issued by the above company. It is called "Catalogue No. 5," and is a handy book of information as well as a trade catalogue. Besides enumerating the numerous telephone articles manufactured and sold by the company, the book contains a complete list of electrical supplies of every description, such as motors, lamps, alarm clocks, phonographs, graphophones, telegraph instruments, medical batteries, etc. It also contains numerous valuable diagrams of connections, wire tables, electrical data, list of books and a complete index. This company is located at 337 Dearborn street, Chicago, Ill.

"Some Facts about Batteries."

This is the name of a little pamphlet sent out by Wm. Roche, maker of "New Standard" dry batteries, located at 259 Greenwich street, New York. He calls attention to the fact that he has made over 1,250,000 cells that have been sold under the names of "Exeter" and "Mesco," and which were made from a formula known only to him. The "New Standard" is claimed to possess great strength, life, quick recuperation and economy superior to all. It is a good battery for telephone work and is well adapted for electro-medical apparatus, dental surgery, gas lighting, railroad signals, etc. The price of the battery is low while the quality is high, and its voltage is from 1.55 to 1.60, and its amperage from 7 to 12. The "New Standard" batteries are made in numerous sizes, one of them, called the No. 2, measuring 3¾ x 1⅞ inches, this being the smallest practical battery made. Physicians have recognized the merits of this battery for portable apparatus.

ADVERTISERS' HINTS

THE STERLING ARC LAMP CO., 214-222 West Twenty-sixth street, New York, have something to say about several styles of their enclosed arcs.

THE WESTERN ELECTRIC CO., Chicago and New York, advertise the Weston station ammeter in sizes up to 30,000 aniperes capacity. They are headquarters for electrical testing, measuring and station instruments.

THE ELECTRICAL EXCHANGE, 166-174 South Clinton street, Chicago, present a revised list of electrical machinery

Digitized by Google

and supplies which they have on hand, ready for immediate shipment.

THE WALKER COMPANY, Cleveland, Ohio, illustrate an isolated plant of 90 k. w. capacity.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia, Pa., publish a letter from a company using a battery as a means of trolley regulation. It is so assuring in its tone as to leave no doubt of the very satisfactory results obtained.

J. JONES & SON, 62 Cortlandt street, New York, advertise toggle bolts.

NEW YORK NOTES.

JOHN A. ROEBLING'S SONS CO. have recently finished a large order for trolley wire, etc., to be used in connecting Odawara and Yokohama, a distance of about forty miles.

J. JONES & SON, 62 Cortlandt street, New York, have taken an export order for their make of switchboards, switches, panel boards, electric light fixtures and sundry specialties. It is a large shipment, intended for the inside equipment of a large electric light plant, and will keep their factory busy for the next six weeks.

INDUSTRIAL RAILWAYS. Under this heading the C. W. Hunt Company, of 45 Broadway, New York, issue a book giving full information on the many perplexing questions which arise in the minds of those contemplating the installation of such tramways. All questions as to best gauge, radius of curves, weight of rail, switches, style of cars, etc., are fully met and answered. Central station managers who have to handle coal and ashes, will find in this book a most valuable guide. The C. W. Hunt Company also make a large variety of coal handling machinery, electric and steam hoisting engines, conveyors, etc.

OSTERBERG & SUTTON, consulting engineers, 11 Broadway, report that they are about to remove to larger quarters in the Bowling Green Building. This is the fourth time in a year and a half that this young firm's business has outgrown its floor space. Among the work which has come to their office during the last few weeks are, besides considerable expert work in the nature of tests, the appointment as consulting electrical engineers for the Trinity Corporation; Patchogue Manufacturing Company, where, by the way, for the first time, large curtain looms are being equipped with direct connected motors; shirt factory of M. Price, in Paterson, N. J.; the Aguilar Public Library, some improvements in the stores of Simpson, Crawford & Simpson, and a number of minor matters.

THE MICA INSULATOR COMPANY, of New York and Chicago, report a gratifying demand for their "Micanite" segments for electric light and power generators. Some heavy orders are being executed at the factory in Schenectady, N. Y. Many of the large generators now under construction have for their commutator insulation "Micanite." The heavy increase of the company's business during the last few months is largely due to the improved process of manufacturing a perfect commutator segment. They offer to send free to any machinery builder or electrical repair concern a set for any one of the smaller machines, free of expense. Parties interested in the economical insulation of electrical machinery will do well to write the company at their office, either in New York or Chicago.

SYRACUSE, N. Y. The Syracuse Construction Company are erecting new buildings in connection with their electric railroad plant. The buildings consist of a boiler house 60x90 feet, which is an all fireproof building, having steel framework covered with corrugated iron on the sides and roof. There is also an engine room 65 feet wide by 80 feet long, having a steel frame and brick sides. The other building is a car barn and repair shop, 65 feet wide and 170 feet long. This building also has steel framework construction, with corrugated iron sides. All these buildings have been designed and are being erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

JOHN THOMSON PRESS CO., 253 Broadway, New York, are issuing some exceedingly handsome blotters, printed on one of their Colt presses, such as was shown at the Electrical Exhibition. The blotter has the American and English flags embossed in colors back of a United States shield which is supported by the eagle, lion and unicorn in gold, with this legend: "America-Britannia; one root, two branches; one language, two flags." The sentiment is good enough for us; the blotter is good enough for any one.

WESTERN NOTES

DETROIT MICH. The Detroit Switchboard and Telephone Construction Co., Majestic Building, are branching out and are now making up the preliminary estimates on work for the entire construction of independent exchange plants at New Orleans, La., and Evansville, Ind. The growth of the Company is an indication of the large amount of work being done in the construction and maintenance of independent exchanges throughout the West and South.

CENTRAL ELECTRIC CO., of Chicago, report a brisk trade on lightning arresters, and are issuing some very attractive circulars on the Wurts arrester, also the Garton arrester.

ELECTRIC APPLIANCE CO. are very proud of the fact that they will soon complete the seventh year of their electrical supply business. The Electric Appliance Co. claim, and we believe justly, that after confining themselves strictly to the electrical supply business as they have for this period of time, they should be in the best possible position to handle that branch of the electrical business successfully. It is very apparent from the volume of business they are now doing and their position in the electrical field that their business has been thus far very successfully handled.

CONTENTS.

EDITORIALS:
The Counter E. M. F. Method of Car Motor Regulation 86
The Present Status of Electro Dentistry 86
Current Density as a Factor in Copper Refining 87
Municipal Street Railways in Glasgow 87
Presentation to the Volunteer Engineer Corps 87
The Age of Automobiles 87

POWER TRANSMISSION:
New Work at Niagara Falls by the Hydraulic Company (illustr.). Orrin E. Dunlap. 73
The Welland Power Canal.—The Abuse of the Power Station 75

ELECTRIC TRANSPORTATION:
Combined Trolley and Accumulator Traction System in Paris (illustr.) 75
Buffalo-Niagara Trolleys.—A Decision for Electric Cabs in Paris... 76
Notes from the Field: Electricity on the Pittsburg Street Railways—II. ..... C. B. Fairchild. 76
Some Phases of the Rapid Transit Problem (illustr.) ..... Albert H. Armstrong. 77
Cost of Operating Electric Vehicles 79
Columbia Electric Motor Carriages (illustr.) 80
The Baldwin-Westinghouse Electric Mining Locomotives (illustr.).. 81
The Eddy Electric Carriage Motor (illustr.) 83
A Big Prize for an Automile Accumulator 84

TELEPHONY AND TELEGRAPHY:
Who Shall Pay the Telephone Tax?—Pacific Cable Schemes.—The Telephone and the Hotels.—Government Controls the Santiago Cable 84
The Telephone Toll Tax.—Report Against Municipal Telephony at Columbus, Ohio.—Municipal Telegraph Chiefs to Meet 85

OBITUARY:
Edward Dexter Brown 85
John Mason Jackson 85

ELECTRIC LIGHTING:
New Lamps of the Sterling Arc Lamp Co. (illustr.) 88

SOCIETY AND CLUB NOTES:
Electricity at the 28th Annual Meeting of the New Jersey State Dental Society, at Asbury Park, N. J. 89

THE STOCK MARKET:
Steady but Sluggish 90

LEGAL NOTES:
Sterne vs. Metropolitan Telephone and Telegraph Co. and New York Telephone Co. 90
Carty's Telephone Bridging Bell 91

REPORTS OF COMPANIES:
The Scaling Down of General Electric Stock 92

TRADE NOTES AND NOVELTIES:
Affairs of the Western Telephone Construction Co.—Multiphase Cable and Lower Fire Insurance Rates 92
The Burton Electric Welding, Forging and Brazing Machine (illustr.).—The Hubbard-Mortson Automatic Time Switch for Turning Off and On Electric Currents (illustr.) 93
Advance of the Storey Motor.—Safety Conduit Company, Pittsburg: The "Loricated" (illustr.).—Orders for Sterling Telephone Apparatus.—Westinghouse Air-Brake Prosperity 94
Mr. Paul Hoenack.—The Holtzer Gas Engine Igniter (illustr.).—Patterson, Gottfried & Hunter.—Chloride Accumulators.—Farr Telephone and Construction Co.—"Some Facts About Batteries."—Advertisers' Hints 95
New York Notes.—Western Notes.—Southern Notes 96

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. AUGUST 4, 1898. No. 535.

MISCELLANEOUS

Means For Detecting the Presence of a Ship or Iceberg.

BY HERMANN HERBERTS.

THE recent Bourgogne disaster connected with such heavy loss of life, such fearful dramatic scenes, where egotism was predominating to such extent, that beastly barbarous means were resorted to in butchering and annihilating the weaker

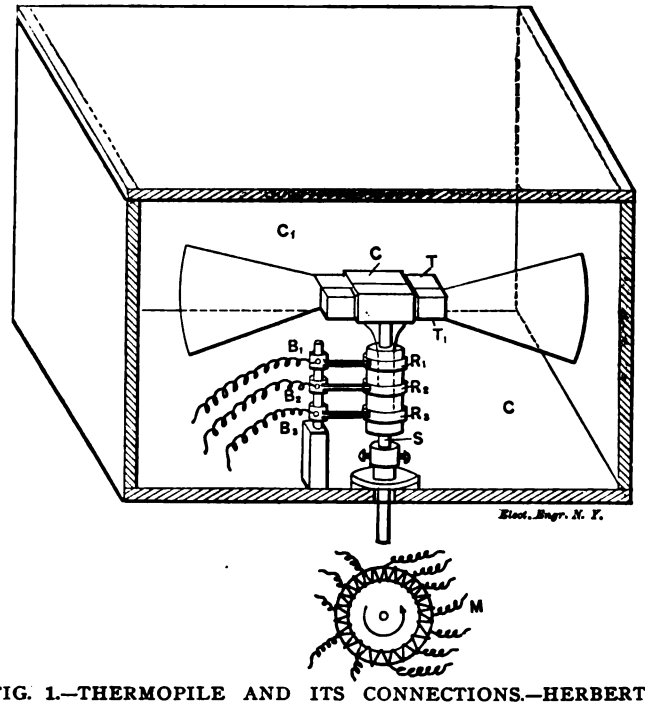


FIG. 1.—THERMOPILE AND ITS CONNECTIONS.—HERBERTS' APPARATUS FOR DETECTING THE APPROACH OF OBJECTS AT SEA.

element, has caused a deep and everlasting impression upon its survivors, upon everybody endowed with a fellow-feeling.

The average person lacks coolness of mind in such critical moments, and losing all self-control shake that of those so far unaffected. It seems to me that travelers should be made familiar with the safety appliances on board, and I venture to express the hope that the Bourgogne disaster will not only cause the different navigation companies to give to their patrons practical lessons in using and applying such expedients, but also such further information as may be of benefit to them in case of accidents. As to the matter of life-boats, improvements seem highly desirable and particularly to quick and efficient means for launching them. Many lives were lost just on account of this deficiency. It should be made compulsory for each vessel to have a total carrying capacity of their life-boats, exceeding by 10 or 20 per cent. the maximum number of passengers carried. This Bourgogne disaster has stimulated within me the desire of finding some such suitable means whereby collisions at sea may be avoided.

Before entering into a discussion of these it may be in order to mention a few methods of signalling, now in use.

In a dense fog, of course auricular signals must be resorted to, and among these we have with an approximate hearing distance in miles the following:

The air sirene.....	10 to 12	miles.
The steam sirene.....	8 to 10	"
The trumpet	6	"
The bell	1	mile.

For receiving the sounds the eophone, topophone or similar instruments have been employed with more or less success. The object of these instruments is to furnish a means whereby to determine the direction from which the sound proceeds. Under existing conditions it is necessary that both vessels be active, not only in giving signals, but also in "attempting" to intercept them. The safety of a vessel, therefore, not only rests with its own crew, but largely depends upon the watchfulness of the other vessels.

A good deal of blind confidence is therefore placed in any stranger who may come along; it is not this alone which makes navigation dangerous during a heavy fog, it is made much more so on account of atmospheric conditions which, as yet, are not fully understood. At times, it is impossible to perceive the phonorous signals when the steamer is near by, while the signal was plainly heard from some larger distance. As to the cause of this surprising interruption (seeming) in the propagation of sounds, investigations have been carried on by the United States, Germany and France. The investigations made by Major Livermore in compliance with the U. S. Admiralty have thrown some light upon this subject. It has been deduced that obstructions to sound or an irregular formation

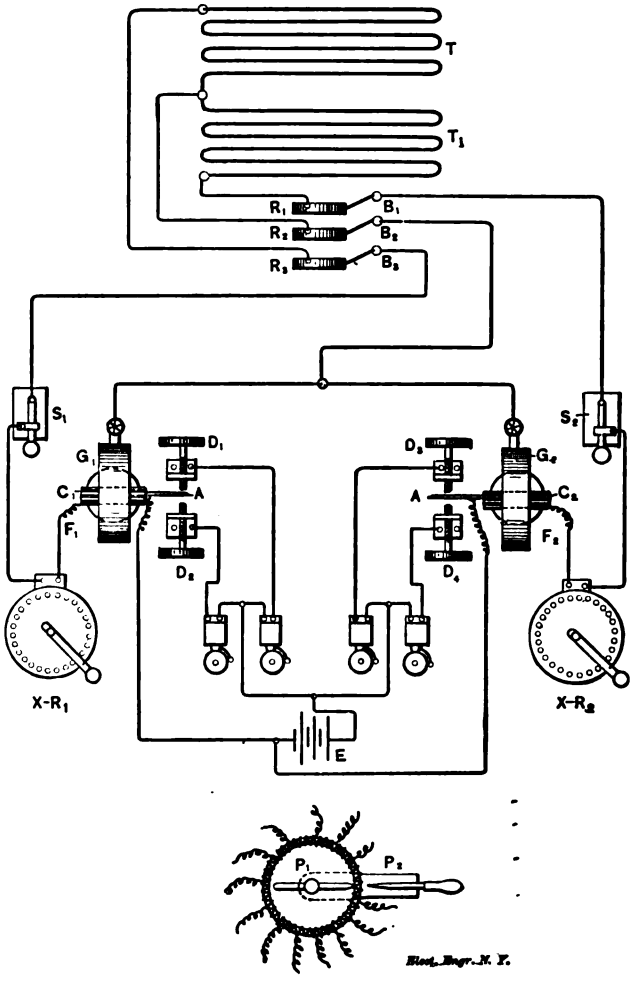


FIG. 2.—HERBERTS' ELECTRICAL METHOD FOR DETECTING THE APPROACH OF OBJECTS AT SEA.

of the coast not only affect the strength but also the propagation of the same. Obstructions behind the source of sound will reinforce them in a similar manner as a screen will reflect the light. Rain and snow will have a great influence upon the direction of the sound.

At the first thought it seems that wireless telegraphy would meet all requirements for signalling. Reflecting upon this will soon convince us that each and every vessel afloat must be

Digitized by Google

equipped with a complete set of apparatus. Even if their use were made compulsory—then again would the safety of a vessel largely be dependent upon the other vessels in a similar manner as outlined above. Although the introduction of this kind of apparatus would make navigation safer, the location and movements of other vessels could nevertheless not be determined. Besides these, there are icebergs and floating wrecks.

Taking all in all, it is desirable to find a means which will indicate the nearness or approach of any object.

It is well known that any object, when its temperature is higher or lower than that of the atmosphere surrounding the same, will either send forth heat radiations, or else, in the other case, absorb heat from its surrounding medium.

If we can construct an apparatus which is acted upon by such heat radiations, and if the apparatus be so sensitive that it will indicate the radiations, even if they be exceedingly weak, then we have a means which may be advantageously employed in navigation. As soon as we can intercept the radiations sent forth from a vessel we need not depend upon our ear or eye to locate the same. A modification of the thermopile or the radiophone may be employed in connection with this problem.

Fig. 1 shows part of an apparatus as proposed by me to the end of detecting the approach or nearness of any vessel, iceberg or obstruction. The two thermopiles T and T_1 are surrounded by an insulating casing C and are attached to a shaft S which may be revolved slowly. The insulated rings R_1, R_2, R_3 serve to establish a permanent connection of the thermopiles with the brushes B_1, B_2, B_3, whence wires may be led to the pilot house to the observation or indicating apparatus. The thermopiles are enclosed in a suitable compartment such as to exclude all air currents and to afford protection from the radiations of the sun and the vessel itself. For this reason the whole is mounted on the outer side of the vessel. A flat ⊃ shaped double walled casing (not shown) surrounds the compartment C_1; the outer chamber of the former is filled with alum solution for the purpose of intercepting radiations due to the rays of the sun, either striking directly or being reflected from the water and also for intercepting those which are emitted from the vessel itself. The inner chamber may be attached to a continuous water supply so as to remove all heat which the alum cell may have absorbed and also to maintain the chamber C_1 at a constant temperature.

Fig. 2 shows a diagram of connections. A junction of two of the free ends of the thermopiles T and T_1 is led to the middle ring and thence over the brushes to the two galvanometers G_1, G_2, here shown of the D'Arsonval type. The other terminals of the galvanometer coils C_1, C_2, connect through adjustable resistances X R_1, X R_2, and switches S_1, S_2, to their respective outside rings R_1 and R_2.

For observation a galvanometer scale may be employed or perhaps an automatic indicating device as shown in Fig. 2. A light aluminum arm A, fastened to the movable galvanometer coil swings between two adjustable contacts D_1, D_2, D_3 and D_4. A local circuit including batteries E and bells is completed should this arm be turned through a small angle. For indicating the exact position of the thermopile a large number of contrivances may be constructed. In these it should be aimed at to have a position indicator P operated by the same current as that which revolves the thermopiles.

Suppose now that in foggy weather, when we cannot see, when we are in fear of being deceived by the sound, we start this apparatus and make ourselves independent of the watchfulness of other vessels.

A vessel approaches—we are not aware of it—the radiations given out by the ship are too weak to affect the apparatus—we come nearer each other—a stronger current is set up in one of the thermopiles at the moment it points in the direction whence the radiations proceed. Instantaneously the galvanometer coil is slightly turned, the aluminum arm makes contact and causes one of the bells to give a short ring. This happens once at every half revolution as then the second thermopile becomes active. As the distance between the vessels diminishes, the effect will naturally increase and a contact is made covering a longer period of time. Watching the instantaneous position of the revolving position indicator P at the moment the bell rings and simultaneously cutting out one of the thermopiles by switch S_1 or S_2, will immediately give us an approximate knowledge of the direction from which the vessel is approaching. To obtain a more accurate knowledge the adjustable resistance may now be manipulated. It being in circuit with the galvanometer the current from the thermopile will, of course, be cut down. Under normal conditions, i. e., with the resistance cut out, the bell will operate for a certain length of time, depending upon the amount of radiations sent forth from the nearing vessel as well as the time of exposure of the thermopile to their influence; this again depends upon the speed of the revolving thermopiles. The purpose of the resistance then is to cut down the action of the thermopile to such extent that the aluminum arm makes contact only at the instant the maximum current is being produced. As this can occur only when the thermopile points directly toward the strange vessel, its position is immediately ascertained by simply moving the contact lever until the bell gives the shortest obtainable ring. For all ordinary purposes the observation of the slowly moving position indicator arm P will therefore be sufficient. A small adjustable pointer P_2 which may be swung around the outside casing of the position indicator P, may serve to fix this position.

By the increased or diminished action of the thermopiles we know whether a vessel approaches or whether it recedes; by watching the position indicator we know whether the vessel is moving toward the right or toward the left. These means therefore enable us not only to ascertain the presence of a vessel, but also to follow its movements and all this is accomplished by simply adjusting the rheostat, listening to the bell and watching the position indicator.

Safely passing the vessel, we now come near an iceberg. The effect is similar as before; the current produced in the thermopile is, however, now flowing in the opposite direction, causing the coil to turn the opposite way and also a different bell to give its warning signal.

It is possible therefore to tell the nature of the obstruction, whether it be a vessel or an iceberg. In the case of a floating wreck, more difficulty is to be expected as its temperature will not differ very much from that of the surrounding atmosphere. It may however be, that if its entire exposed surface is in moist condition a sufficient fall of temperature is produced to affect the apparatus and to do likewise on account of radiations given out due to exposure to the rays of the sun. For the same reasons it may also be possible to tell when nearing a coast.

The double thermopile is proposed for the purpose of increasing the action of the apparatus as then it can be revolved at a slower speed, in that way giving a longer exposure to the radiations—while at the same time the vessel is better protected. A combination of four of these would undoubtedly improve the effects considerably as the speed may then be cut down still lower. A plurality of thermopiles suitably arranged would not require to be revolved. Of course, each side of the vessel should be provided with a complete apparatus.

The indicating apparatus, i. e., the galvanometer should preferably be mounted so as to be free from vibration and in a similar manner as that employed with the compass, to make it independent of the ship's motion.

Now, a few remarks touching upon the radiophone. Berzelius, in 1817, discovered selenium, while Knox, in 1837, found that it was an electrical conductor. May discovered that its conductivity is much influenced by light. In their experiments physicists used the galvanometer, while Bell used the telephone. Bell and Tainter subsequently constructed the photophone, its receiver consisting of metal discs insulated from each other and covered with selenium. A ray of light reflected from a mirror diaphragm which is spoken against, after passing through suitable concentrating lenses is reflected to a distant parabolic concave mirror and thence focussed upon a selenium cell, which has a telephone receiver and battery in its circuit. Sound was in this manner transmitted over a beam of light. Later experiments showed that sound can be transmitted more efficiently by non-luminous heat rays. Mercadier then constructed the radiophone. In this instrument soot or lamp-black is made use of, forming a bridge between the two electrodes which are in circuit with battery and telephone. In some experiments Graham Bell used a bottle or test tube, covered or filled with soot. Throwing the focussed light on these would produce a sound if the rays be of intermittent nature.

It is a fact then, that heat rays will affect the conductivity of such radiophonic apparatus. Whether their application to the above end could be accomplished, seems at this moment difficult to answer. If its sensitiveness can be brought up to that

Digitized by Google

of the thermopile, and if no serious mechanical difficulties be met in maintaining the soot in the proper place, then it would become a simple matter to apply the radiophone also for the purpose stated.

My conception of applying these means dates back to July 7, 1898. I will not commit myself in stating that such methods as outlined above are absolutely feasible under all conditions; nevertheless, they appear worthy of a careful perusal and study. Certainly a large number of factors must be dealt with in the attempt of solving this problem so fascinating and interesting, such as for instance the effects of warm winds, the Gulf stream and others.

Seeing all the possibilities, I most heartily advance these rather incomplete ideas and hope that the press here as well as abroad will contribute its share in discussing the subject. I also express the hope that all those interested will not withhold their ideas and further, that influential parties will lend their aid to bring about a realization of this problem.

A Capillary Electrometer for Electrical Measurements.[1]

BY CHARLES FREDERICK BURGESS.

MANY of the measurements made in practical engineering work require the use of a sensitive electrical instrument, and owing to the demand for such an instrument the galvanometer has reached a high degree of perfection in some of the latest and improved forms. There is still much to be desired, however, in the way of portability, rapidity of reading, simplicity, cost and freedom from the effects of external influences such as mechanical vibration and varying magnetic field.

It is my purpose to call attention to the applicability of the capillary electrometer for practical electrical measurements, as a means of overcoming some of these defects. Although the principle upon which this instrument works was discovered about twenty years ago, its use has hardly extended beyond a very limited application in scientific research, and from some of the excellent properties which it holds as a measuring instrument this seems to be a surprising fact.

This principle is the change of surface tension of two liquids

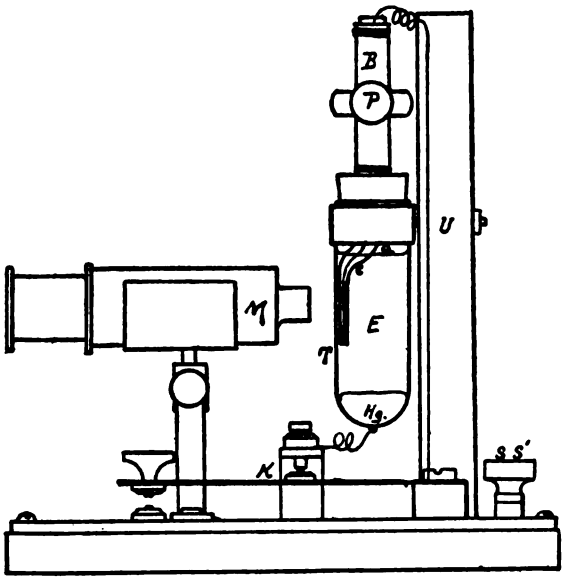


FIG. 1.—BURGESS CAPILLARY ELECTROMETER.

which are in contact (preferably mercury and dilute sulphuric acid) in a capillary tube, and the meniscus which is formed at the separate surface moves, upon the application of a potential difference to the two liquids in question. It is the movement of this meniscus which corresponds to the movement of the galvanometer needle in using it as a measuring instrument.

The only reason for the comparatively limited use to which the capillary electrometer has been put appear to be that it has not been made into a portable form, as glass and two liquids enter into its construction, and that great care is necessary to keep it in good condition. The form of instrument herein described was designed with the view of overcoming these objections. Fig. 1 illustrates the construction, T being a rather thick glass tube having a platinum wire sealed in the lower end. A layer of mercury covers the platinum wire, and the tube is nearly filled with the electrolyte E, which consists preferably of a dilute solution of sulphuric acid. A capillary tube C, made by drawing out a piece of thermometer tubing, rests against the side of the glass and is held firmly in place by a tightly fitting rubber stopper inserted in the top of the large glass tube, enclosing an air space A above the electrolyte. A piece of flexible rubber tubing is fitted on the upper end of the capillary and

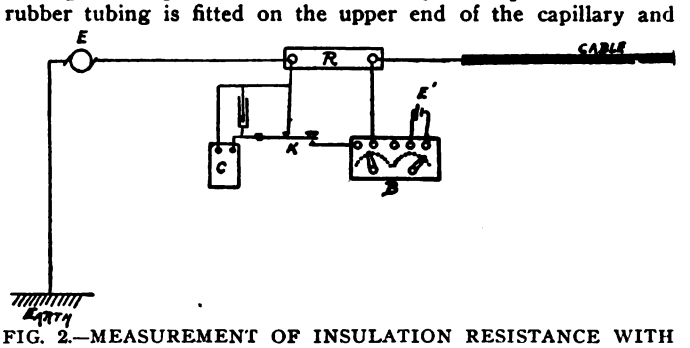


FIG. 2.—MEASUREMENT OF INSULATION RESISTANCE WITH BURGESS CAPILLARY ELECTROMETER.

wrapped tightly to prevent leakage. This tube, being filled with pure mercury, is closed by a piece of glass into which platinum wire is sealed and again wrapped tightly with copper wire. On compressing the pinch-cock P, mercury is forced through the capillary and upon slightly releasing the pressure the mercury is drawn back, being followed by the electrolyte. The instrument is then ready for use. A microscope M containing a micrometer eye-piece is held on an adjustable support and is used for noting the movement of the meniscus. The glass tube is held firmly by a brass collar attached to an ebonite upright. Two binding posts, S S, form the terminals of the instrument, K being the key which short-circuits it when not in use and connects the electrometer with the binding posts when depressed. The connecting wires are placed in grooves between the two parts of the base.

This instrument is one which may be tipped in any position without injury; it is as portable as any instrument made partly of glass can be, and it may readily be taken apart for the purpose of cleaning or renewing its parts. It will respond to a difference of potential of one one-thousandth of a volt, though with proper attention to its construction and by use of a suitable microscope its sensibility may be increased ten-fold or even greater. If a pressure over a volt is applied to the terminals an electrolytic action will occur, with the liberation of a bubble of gas or the formation of a cloudy precipitate at the meniscus, depending upon the polarity. This will destroy the sensibility, but the defect can be easily remedied by compressing the rubber tube until a drop of mercury flows through, and on releasing the pressure the instrument is again ready for use. The adjustment of the meniscus on the micrometer scale may be made either by moving the microscope or by means of the pinch-cock.

The direction of movement of the meniscus depends upon the polarity, and the extent is approximately proportional, through a limited range, to the potential. This is not absolutely so, for it would entail the use of a capillary of absolutely uniform bore, which would be difficult to attain. For this reason it is almost essential to use it as a zero instrument.

The meniscus moves, not by reason of a passage of current through the instrument, but by the application of a potential difference which gives it a certain electrostatic charge. In other words, it may be said to be a condenser which automatically registers the amount of charge which it holds. An addition of resistance in circuit will in no wise decrease its degree of sensitiveness, though it will make the movement of the meniscus somewhat slower. With the instrument described, an application of a pressure of .005 volt produced a deflection of eight divisions on the scale, whether this pressure was applied direct or through a resistance of 100,000 ohms.

On pressing the electrometer key the meniscus will move very rapidly if a potential difference exists at terminals, and again on closing the short-circuit key it will quickly return to its zero

[1]Read before the 15th General Meeting of the American Institute of Electrical Engineers, Omaha, June 27th ,1898. Abstract.

Digitized by Google

point without vibration. It may be subjected to almost any amount of mechanical vibration without moving the position of the meniscus on the scale.

The principal characteristics may be summed up as follows: The instrument is of very simple construction and can be made by any one fairly expert in glass manipulation. It is very light and compact, and requires little space for its operation. The instrument described weighs two pounds and occupies a space of 7" x 5" x 6". In the way of portability little more can be desired. It may be quickly set up for use, requiring no leveling. and the adjustment may be rapidly made. No serious damage such as a burn-out can occur by the accidental application of even a very high pressure. The breakage of any of its parts can be repaired with little trouble and at slight expense. One of these instruments has been in use for nearly a year, and the only repairs necessary on it was in once refilling the rubber tube with mercury. The entire absence of the effect of mechanical vibration and varying magnetic field will especially recommend this instrument. On the other hand, it can hardly be made with the degree of sensitiveness which may be given the galvanometer, and it has to be used as a zero instrument.

Measurement of Insulation Resistance.—On account of the electrometer being a zero instrument, the direct deflection method cannot be used, and a compensation method is employed the method of operating being as follows. Fig. 2 shows arrangement of connections for the test.

A known resistance R (preferably 1,000,000 ohms) is placed in series with the generator and the insulation to be measured. The electronometer C is employed in measuring the fall of potential across R by the compensation method of introducing a pressure in series with the electrometer, which shall just neutralize the pressure across R. When this has been effected the depression of the electronometer key will produce no movement of the meniscus. It is therefore necessary to have an electromotive force which may be varied at will. A resistance box of this nature was described by the author.

The data necessary to derive the value of insulation resistance then is the value of the compensating e. m. f., which may be obtained directly from the reading of the box B when a balance has been effected. Any ordinary form of primary or secondary cell may be used for pressure E^1. The expression for insulation resistance is

$$\text{Resistance} = \frac{E \times 1{,}000{,}000{,}000}{E^1 \times B} - 1{,}000{,}000.$$

The constant is 1,000,000,000 E/E^1, and the ratio E/E^1 may be derived by means of a voltmeter, or if such instrument is not available, by balancing the smaller pressure in circuit with the electrometer and terminal A B against the larger pressure connected to C E, the volume being 1,000 ÷ box reading.

The author also described a method for employing dynamo pressure in testing.

Values for insulation resistance may be obtained with considerable accuracy and speed, and values as high as 20,000 megohms have been measured. The limit may be made very much greater by increasing the sensitiveness of the electrometer or by increasing the value of R.

A portable testing set which I have been using for some time consists of the following parts: Chloride of silver testing battery of about 50 volts, capillary electrometer with microscope and short-circuit key, graphite resistance of one megohm, thousand-ohm subdivided resistance box, a 1.5-volt dry cell. The weight of set, exclusive of 50-volt battery is six lbs., the chloride of silver cells weighing 10.5 lbs. The range is from 0 to 5,000 megohms.

The electrometer with subdivided resistance box may be used for the measurement of direct pressures up to 150 volts with an accuracy of one-tenth of 1 per cent., provided the resistance is accurate. The standard of comparison is the standard cell of known e. m. f.

Values of current may be obtained by the use of standard resistances of large current carrying capacity, the drop through such standard being measured by connecting it in electrometer circuit. The calibration of direct current ammeters and voltmeters may be conveniently and rapidly carried out with the above arrangement.

This form of electrometer is especially suited for use in the dynamo room or in the neighborhood of moving machinery, on account for the small amount of space necessary for its operation, the rapidity with which measurements may be taken and the entire freedom from external influences. It has been used to a considerable extent in the laboratories of the University of Wisconsin in obtaining current and pressure curves on alternating current machinery, and has proved satisfactory where other forms of measuring instruments had failed. The method of using this instrument for tracing alternating current curves is in substituting it for the galvanometer or the telephone receiver in the method proposed by Mershon. It is superior to the telephone receiver. The degree of accuracy is considerably greater as is also the rapidity with which curves can be taken. For use in this work a microscope is unnecessary, and when the movement of the meniscus is too rapid and of a fluctuating nature due to unsteadiness of the compensating pressure or other causes, a condenser may be used as a damper. A resistance placed in series with the electrometer will also serve to increase the period of movement of the meniscus.

The above are some of the measurements in which the use of the electrometer has been tested, and the many advantages which have been found for it leads me to believe that it might be advantageously used in many other measurements in practical engineering work, especially in those where a great degree of sensitiveness is not required. In any of the modified forms of Wheatstone bridge methods for the measurement of resistance, induction and capacity it should prove a serviceable instrument. For use on shipboard it would be the ideal instrument as far as the rolling and the jars due to moving machinery are concerned.

Another property of this instrument, and one which might be utilized to advantage, is the great rapidity with which the meniscus may move under a variation of pressure. It has been shown that alternating curves of a frequency of 120 per second may be obtained by a photographic record of the excursions of the meniscus, as well as the currents of much greater frequency which the telephone line transmits.

New Transformer Plant at Buffalo for Niagara Power.

BY ORRIN E. DUNLAP.

THE first group of transformers built by the Westinghouse Electric and Manufacturing Company for the Ohio street transformer station of the Cataract Power and Conduit Company has been installed. They are four in number, three of them to be used for regular service, and the fourth to be kept as a reserve in case of accident to one of the other three. Each of these transformers is of 850 kilowatts capacity. They are water-cooled and nine feet and one inch high, while their diameter is a little over five feet. The weight of one of the transformers is nearly 20,000 pounds. The aggregate capacity of the three transformers is 2,550 kilowatts, the largest output, it is said, yet obtained from a single group of transformers. The illustrations show the outer casing of the transformers, which contain the oil, being of heavy boiler iron. They are mounted on base plates of cast iron. A cast iron cover on the top is provided with manholes to facilitate the examination of the terminals. On the primaries the star connection is used, and on the secondaries the delta connection.

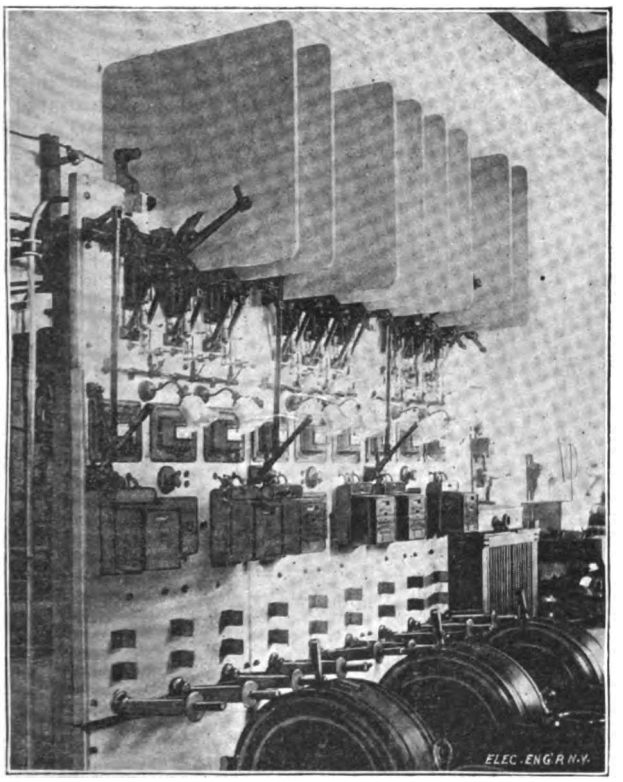
The winding of the transformers is made of deep, thin coils, magnetic leakage being reduced by the primary and secondary being interleaved. Heavy end frames hold the short iron together. Outside the iron the various coils are spread apart, thus increasing the cooling surface exposed to the oil without loss of space. Spacing strips placed at intervals when the iron was set in position about the coils serve to increase the surface of iron exposed to the oil. When the transformers were made each coil was insulated and treated separately, after which they were placed in position with sheets of solid insulating material between them. Running down about half the depth of the case of each transformer are three coils of iron pipe, and through this pipe the water for cooling is circulated. Each of

Digitized by Google

the coils, which are connected in multiple, is fitted with a valve in order that the flow through the respective coils may be adjusted as desired. After this adjustment is properly made, the transformer will continue to do its work with but little further attention.

The building in which the installation has been placed is of brick, the dimensions of the transformer room being 90 by 18 feet. It is the intention, as the demand for power increases, to install three such outfits as that mentioned, and when this is done the total capacity of the station will be about 10,000 horse power. Considering the space occupied, it will be seen that the installation will be in very compact form. Were the power output of the complete installation devoted to lighting, it would supply about 120,000 lights. In the general view of the interior of the station, it will be observed that the large transformers have been placed on one side of the narrow room, while the other side is occupied by the low series transformers and low tension switchboard; and in front of this switchboard will be seen the regulators. The high tension switchboard is to be seen projecting over the top of the large transformers. In time the high tension switchboards will occupy the end of the room where the temporary installation is at present located. The voltage at which the Niagara power is transmitted to the station at Ohio street is 11,000, and it is distributed to the plants using it at a voltage of 2,200, the locality surrounding the station in which there is likely to be a large and growing demand for power. At present current is furnished to the Union Dry Dock Company, the Great Northern Elevator and the Electric Grain Elevator. Many other elevators surround the station, and no doubt some of them will soon become converts to the use of the ever constant power supply from Niagara.

The low series transformers are six in number, each of 75 kilowatts capacity. They are located in the rear of the low tension switchboard. These transformers are intended to regu-

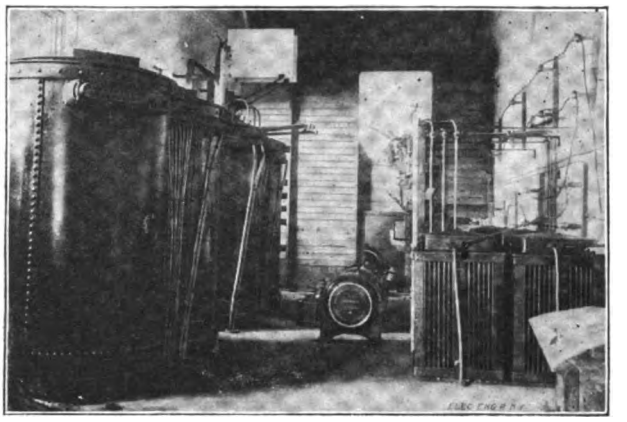


LOW TENSION BOARD, CATARACT POWER & CONDUIT CO., OHIO STREET STATION, BUFFALO.

late the secondary voltage and have the same principle as the large transformers, while of different type and practically self-cooled.

Standing in front of the low tension switchboard are three regulators, on the exterior of which are two dials. On top of each of the regulators will be seen a handle, the movement of which in one direction operates the dial in one phase and movement in the other direction operates it in the other phase, thus alternately changing the voltage in the two phases. The wheel to the left of the regulator operates the switch for reversing the primaries of the series transformers, the lighting of a lamp seen on the regulator indicating when the contact arms are in proper position.

The low tension switchboard is equipped with a new type alternating current breaker and the ordinary type of switch. The board is of white marble and has three panels, each control-



GENERAL VIEW OF OHIO STREET TRANSFORMER STATION, FOR NIAGARA POWER.

ling one three-phase feeder. The board has circuit breakers, switches, A. C. ammeters, A. C. voltmeters, and integrating voltmeters. The wire used in connection with the board is 0000.

The high tension switchboard is quite narrow and high. It is provided with three circuit breakers, each having a break of 48 to 50 inches. They have long wooden arms, the contact being made on the terminal, the lead being carried up in the arm. The contact is made with a copper terminal and a carbon terminal, the two forming one terminal. The break comes first on the copper and then on the carbon. As all the burning is on the carbon, the contact surface is not damaged. The different high tension currents can be thrown into the converters by a plug system at the bottom of the board. The wire of the board is No. 000.

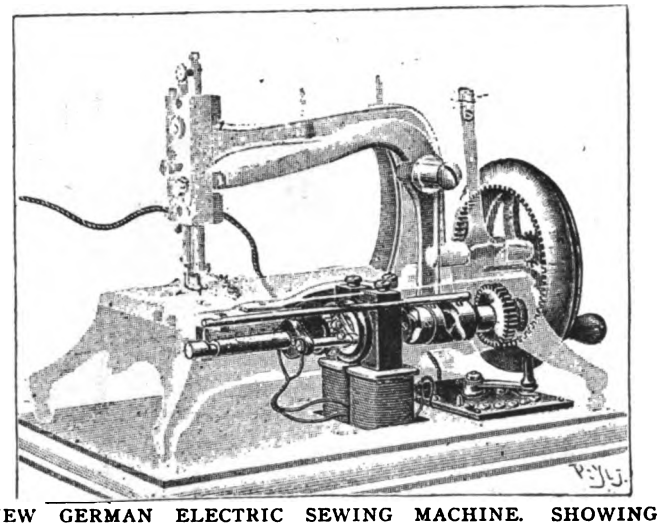
The transformers and other apparatus of the station were installed under the personal direction and supervision of Mr. W. K. Dunlap, who is the efficient local engineer of the Westinghouse Electric and Manufacturing Company. In this connection it may be stated that the Cataract Power and Conduit Company are preparing to erect a new terminal station a short distance north of the Bullymore malt house on Niagara street, in which vicinity there is a demand for Niagara power.

A New German Electric Sewing Machine.

IN electric sewing machines constructed up to the present time, the motion has been accomplished by means of a small belt running over the pulley of the motor and the wheel of the sewing machine. In the new machine illustrated herewith, the electric motor is mounted directly on the axle. It will be seen from the figure that the shaft which gives the reciprocating movement to the shuttle and needle carries the armature of the motor. To the frame of the machine are fastened the brushes which lead the current to the commutator. The machine can be inserted in place of an incandescent lamp, as it only consumes .7 of an ampere at 110 volts and makes 1,000 revolutions per minute. The field magnets are made of soft wrought iron, giving an intense magnetic field. The armature contains a number of windings grouped in twelve sections. The small motor is shunt wound, and on the base of the sewing machine is fastened a small rheostat which is inserted in the main circuit and can be varied so as to give the machine a speed of from 180 to 1,800 revolutions per minute. The machine stands with four feet on a wooden table. The electric motor which is attached to the machine itself, has its field magnet fitted into an opening in the base. The two back legs of the machine are provided with hinges which allow the throwing open of the machine for inspection, oiling and regulation. At the right of the machine the inventor has affixed a wheel which can be turned by hand and will transmit motion to the various parts

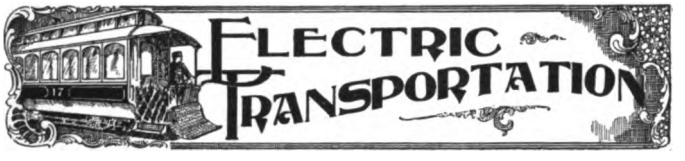
Digitized by Google

by means of a gear wheel. At the top of the machine a small spooling device is attached, which can be set in motion either



NEW GERMAN ELECTRIC SEWING MACHINE. SHOWING MOTOR AND CONNECTIONS.

by hand or by motor. We are indebted to the "Electrotechnisches Echo" for the above details and illustration.



French Tests of Electric Cabs for City Service.

A MOST interesting and valuable test of electric cabs for city service was carried out in Paris for a period of eleven days beginning with the first of June last under the supervision of a commission presided over by M. Forestier, inspector general of bridges and roads of the French Government, so that the test may be considered as absolutely authentic. In this test there were entered eleven carriages, all provided with the

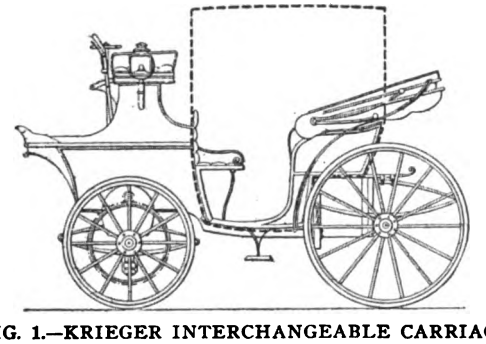


FIG. 1.—KRIEGER INTERCHANGEABLE CARRIAGE.

Michelin pneumatic tires with the exception of two cabs, the rear wheels of which had solid rubber tires. A very complete description of these tests is given by M. Hospitalier in "L'Industrie Electrique." All carriages were provided with the Fulmen storage battery.

This storage battery, designed for automobile vehicles, as Mr. Hospitalier points out, ought to have two essential qualities. One is high specific power (watts per pound total weight) and second a high specific energy (watt hours per pound of total weight). The following are some of the figures given by Mr. Hospitalier of tests made by him on the Fulmen accumulator, type "B" 15. The battery contains 13 plates, six positive and seven negative. The plates are rectangular, 18.5 cm. high, 9.5 cm. wide, and 4 mm. thick, consisting of a grid with 24 sockets, in which the active material is placed. The total weight of the complete element and liquid is about 7.5 kg. The data of the element as referred to the total weight are as follows:

Specific current in amperes, per kg	3.
Specific useful power in watts, per kg	5.3
Specific capacity in ampere hours, per kg	14.6
Specific useful energy in watt hours, per kg	26.
Specific weight in kg. per kilowatt	190.
Specific weight in kilogram, per kilowatt hour	37.5

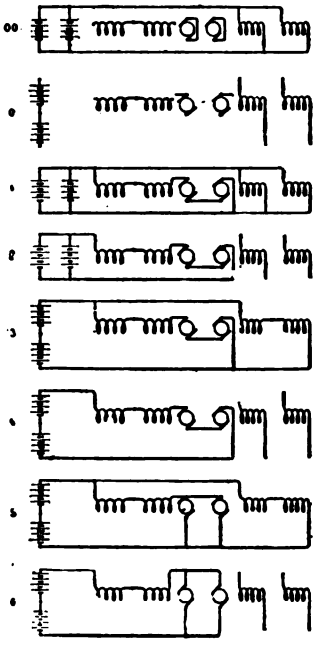
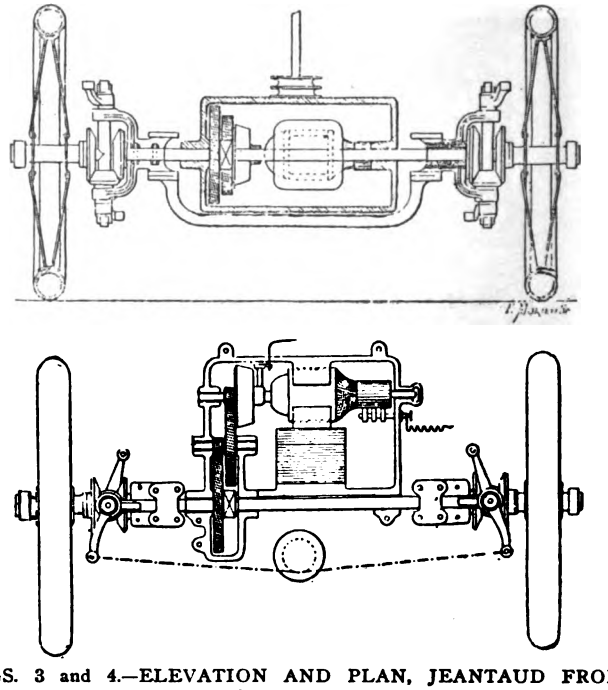


FIG. 2.—KRIEGER CONTROLLER COMBINATIONS.

Operating at 5 watts per kilogram, the Fulmen accumulator thus has a capacity of 25 watt hours per kilogram.

Four Krieger cabs were tested and differed only in the interchangeable character of the superstructure as illustrated in Fig. 1, the cabs being so arranged that they can be readily changed from victorias to closed cabs according to the state of the weather. Each cab contains 22 Fulmen storage cells of 17



FIGS. 3 and 4.—ELEVATION AND PLAN, JEANTAUD FRONT AXLE MOTOR.

plates, each weighing 10.4 kg. per cell. The controller is arranged for eight combinations illustrated in Fig. 2. At certain speed the positions 1 and 3 produce a braking effect to limit the speed of the cab. Braking in the position o o is more energetic and acts at low speed. The foot brake produces a complete stop. There are neither shoe brakes nor brakes of any

Digitized by Google

other kind. The stop on the heavy grades is accomplished by an expedient which consists in working the controller in a sort of tremolo movement between the positions 60 and 1. This arrangement, however, will be abandoned by M. Krieger in his new cabs for a band brake.

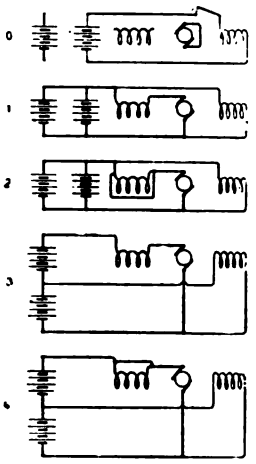


FIG. 5.—JEANTAUD COMBINATIONS FOR FRONT AXLE MOTOR.

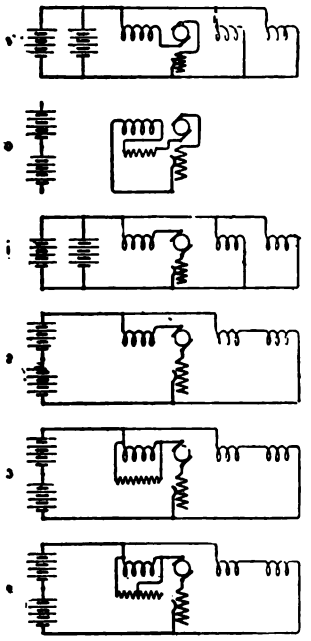


FIG. 6.—JEANTAUD CONTROLLER COMBINATIONS.

The cabs of the Compagnie Générale des Transports Automobiles were built after designs of M. Jenatzy who adapted the cabs of the company to a suitable running gear. The single motor employed actuates an intermediate shaft on which is mounted the differential gear and the ribbon brake, acting in both directions. For heavy grades a mechanical speed changer operated by a lever allows the speed to be reduced in the ratio of 100 to 67.

M. Jeantaud had entered in competition a cab the running gear of which is illustrated in the engravings Figs. 3 and 4. The single motor employed is placed under the seat of the driver, driving a differential gear the axis of which is in the prolongation of the wheels when the latter are in the position of moving straight ahead. To transmit the power when the

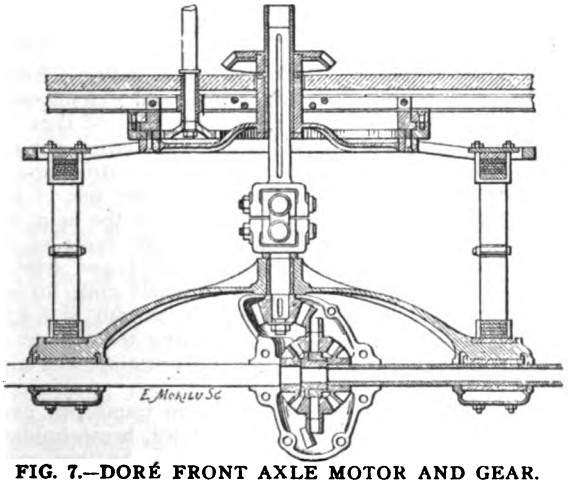


FIG. 7.—DORÉ FRONT AXLE MOTOR AND GEAR.

wheels are not in the straight ahead position, a conical transmission gear is employed. Figs. 5 and 6 show the motor controller combinations for Jeantaud carriages.

In the test which took place the eleven carriages were required to make a daily run of 60 kilometers each, and from the table of tests it would seem that the actual consumption at the battery terminals is about 80 watt hours per ton kilometer at discharge, and 110 watt hours per ton kilometer when charging. M. Hospitalier remarks with satisfaction that these figures are lower than those which were obtained only a year ago in the tests of Messrs. Morris and Salom, so that progress is manifest.

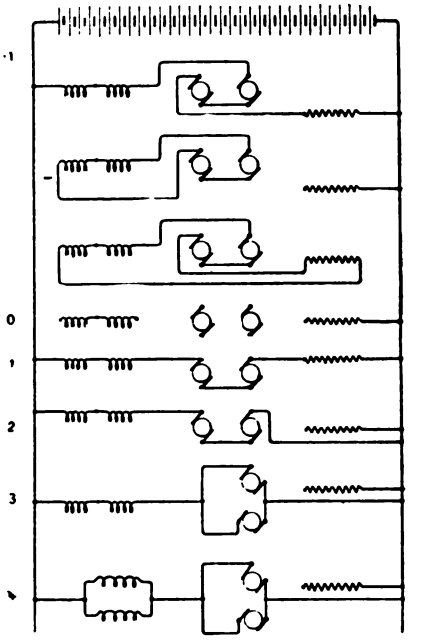


FIG. 8.—CONTROLLER COMBINATIONS, CIE FRANCAISE.

The test also included a determination of the cost of operation of the various types of cabs, horse, petroleum and electric. These were as follows:

Horse, per day	19.37	francs.
Petroleum, per day	28.37	"
Electric, per day	19.85	"

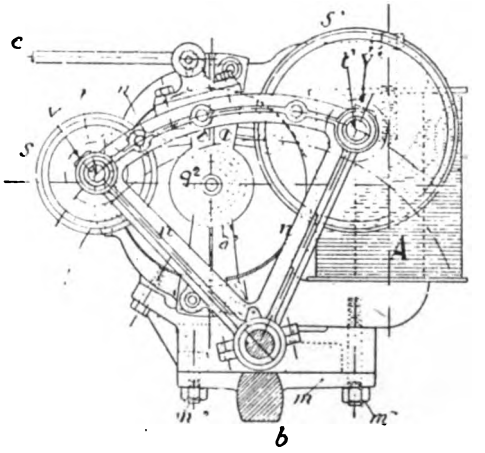


FIG. 9.—DETAILS, PATIN CARRIAGE.

It would thus seem that under actual conditions the cost per day of an electric cab would be about 50 centimes (10 cents) greater than that of a horse cab. Now since this sum of 50 centimes represents very closely the profit of the large com-

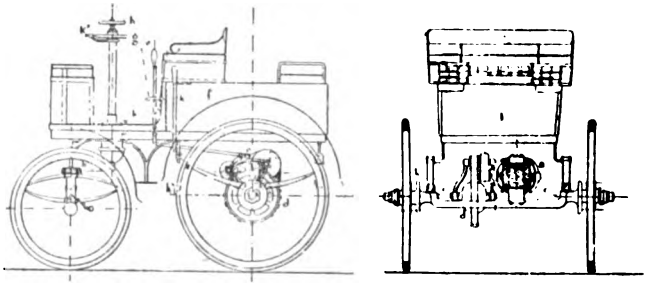


FIG. 10.—ELEVATION AND END VIEW, PATIN CARRIAGE.

panies, this profit would be found to be reduced to nothing. These pessimistic conclusions ought not, however, to be ac-

Digitized by Google

cepted without reserve, for since the expense of the horse cabs can hardly be reduced any more, such is anything but the case with electric cabs. The first experiments with the latter date back no further than three years in France, and the first applications in America and in England date back scarcely more than a year. M. Hospitalier hardly believes that perfection will be reached even at next year's competition. This year's test has proved that the electric cab is possible and that it is

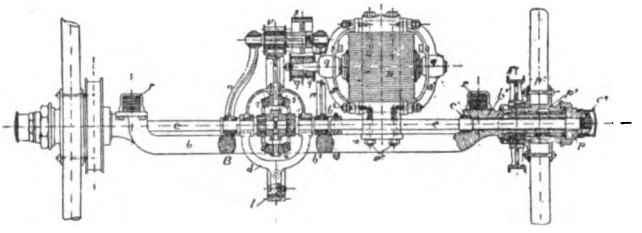


FIG. 11.—TRANSVERSE SECTION PATIN CARRIAGE.

the only possible one. Before two years have passed he believes that tne electric cab will be an economic success.

At the international exposition of automobile vehicles organized by the Automobile Club of France, concluded on July 3, a large variety of vehicles were exhibited. The engraving Fig. 7 shows the arrangement of the gear of the Doré electric cab. A series motor was employed with a vertical axis placed directly on the driving shaft and acting directly on the latter. The armature of this motor has three windings connected in series. The controller is here replaced by three handwheels, the first of which breaks the current and introduces varied resistances into the circuit. The second throws out of circuit one or two of the three windings of the armature; the third reverses the current in the armature for backing.

Mr. O. Patin exhibited four carriages, one of which is illustrated in the engravings, Fig. 10. The motor rests directly on the rear axle which is depressed at the centre b between the suspension springs so as to present a lower level to that of the ends b, through which pass the shaft of the motor c. At the centre of the carriage the shaft b has an oval section so as to allow the passage of the driving gear d. The motor a is held by the bolts m solid with the axle. The motor shaft receives its movement from the differential gear which passes through the ends of the shaft. Figs. 9 and 11 show details and a transverse section of the carriage respectively. Fig. 8 shows

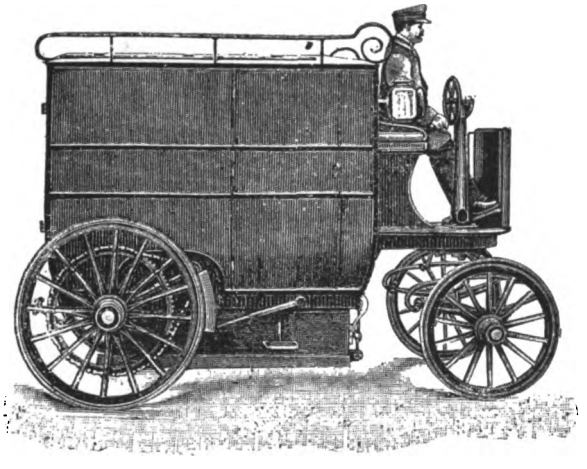


FIG. 12.—PARCEL EXPRESS WAGON.

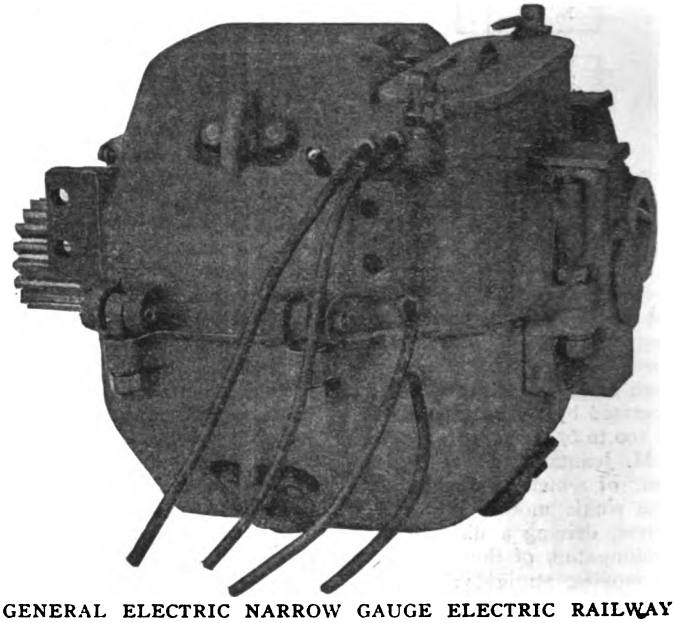
the motor controller combinations for a carriage built by the Cie Francaise. Fig. 12 illustrates one of the electric delivery wagons of which two were exhibited.

DALLAS, TEX. Mr. W. H. McGrath, vice-president and general manager of the Dallas Electric Co., is pushing a scheme for a network of electric roads radiating fifty miles around that city. Ex-Mayor F. P. Holland is also interested, and northern capital is being enlisted to carry out the scheme.

General Electric Narrow Gauge Railway Motors.

THE operation of a narrow gauge road demands a railway motor occupying a more restricted space than the motor built for standard gauge roads, while giving the same power. The General Electric Company has manufactured narrow gauge motors for some time past, and many are in actual service giving the same high degree of satisfaction as the other types of the G. E. standard gauge motors. One type of narrow gauge motor now built is the G. E. 58 which resembles in outer appearance the standard gauge motor and has an output of 37 h. p. based on the standard General Electric rating, i. e., a maximum rise of 75° centigrade in the temperature of the windings after a run of one hour at rated load, the temperature of the surrounding air not exceeding 25° C. This motor is built for comparatively heavy service in which the G. E. 52 motor would be too light and is especially desirable in cases of combined city and interurban service with moderately high speeds and heavy traffic. While designed for a minimum gauge of one meter (39¼ inches) the G. E. 58 may be used with wider gauge roads.

Magnet Frame.—The magnet frame is made of soft steel of high magnetic permeability, cast in two bowl-shaped halves. The frame is divided in a horizontal plane, and the two parts when bolted together completely enclose and protect the arma-



GENERAL ELECTRIC NARROW GAUGE ELECTRIC RAILWAY MOTOR, CLOSED.

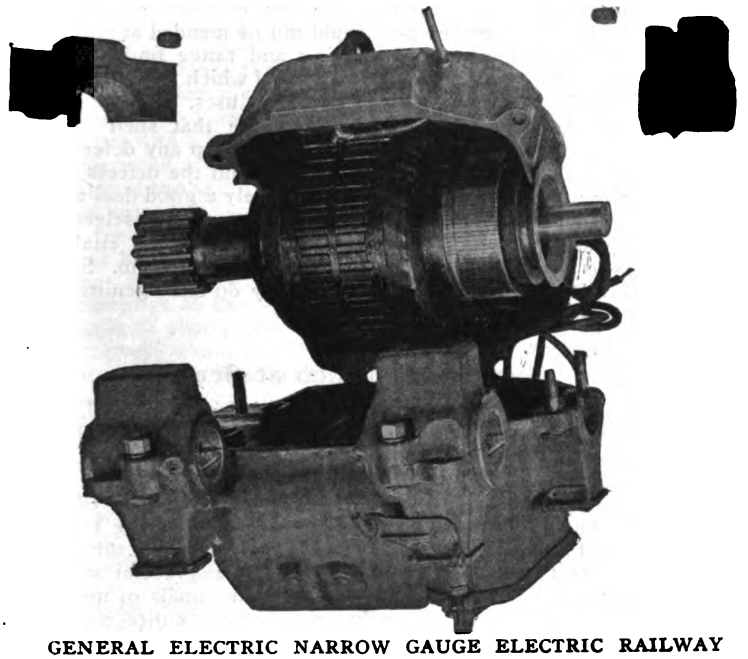
ture, commutator, brush holders and field coils. Extension pieces are cast on the top at each end, and extend over and partly enclose the car axle. To the under side of these extension pieces are bolted the axle bearing caps bored out to support and enclose the axle linings. The armature supports are made by bolting the bearing caps to the under side of the top frame at each end and boring them to receive the linings. The bottom frame is secured to the top frame by bolts so hinged that when the rear bolts are removed the lower frame will swing down, exposing the armature and field coils for inspection and cleaning. In this position the bottom of field coils may be easily taken out, while by removing the armature caps and the bottom half of the gear case, the armature and top field coils may be easily removed.

A large opening is provided in the top frame just over the commutator, through which the commutator, brush holders and brushes can be inspected and worn out brushes replaced. Through the same opening it is possible to remove the brush holder yoke and brush holder bodies. A malleable iron cover is securely held in place over this opening by an adjustable cam-locking device and is easily and quickly removed. A hand hole fitted with a gasket and cover plate is provided in the bottom frame directly under the commutator, permitting easy access to the bottom of the motor for inspection and removal of foreign substances.

Bearings.—Appreciating that the renewal of linings is frequently the principal item of maintenance cost of a motor, par-

Digitized by Google

ticularly when designed within the limitations of narrow gauge, much attention has been given to the design of the linings and the bearings. The armature bearing linings are made of machined cast iron with 3-16-inch Babbitt metal swaged hard and bored to the proper size to fit the shaft. The bearing of the commutator end is 2 5-8-in. x 6 5-16-in., and on the pinion end 3 in. x 7 7-8 in. The supports for the linings are constructed on the outboard plan, which renders the bearings easily accessible and prevents oil or grease from working into the motor frame. The support for the upper half of the armature shaft lining is cast as a part of the upper half of the frame and is provided with a large cored recess between the inner end of the lining and motor frame. This space is utilized for a thrust collar so designed that its outer edge acts as an oil guard and turns in the recess between the motor frame and the bearings. The support for the lower half of the lining is a cap bolted to the upper frame in such a way as not to enclose the lower half of the oil guard, thus allowing free egress for the lubricant after it has passed through the bearing. The axle bearing linings are similar to the armature bearing linings and are 8 inches in length and of the required diameter to fit the car axle. The upper supports for these linings are cast with the upper frame; the lower supports are caps bolted to the upper support. All bearings on the motor are provided with grease boxes and oil cellars of sufficient capacity for thorough lubrication. The grease boxes are cast with the upper frame and are covered with



GENERAL ELECTRIC NARROW GAUGE ELECTRIC RAILWAY MOTOR, OPEN.

flanged lids held down by springs to exclude the dust and dirt. Oil cellars of ample capacity are provided in the bearing caps. The oil is fed by felt wicks or wipers, which come in contact with the shaft through holes cut in the linings.

Field Coils.—The motor has four field coils; two in each frame, placed at an agle of 45° from the split and held in place by pressed steel flanges, or spool holders, clamped by projections on the laminated pole pieces. The pole pieces are held in place by through bolts with nuts on the outside of the frame, the coils being placed in position when the pole pieces are bolted to the frame. The field coils are wound with round wire insulated with asbestos, and are substantially insulated over all with wrappings of varnished cloth and tape. The insulation between field coils and motor frame is tested by 5,000 volts alternating—sufficient to thoroughly prove the quality of the insulation. The field coil leads are brought out through the frame in a convenient manner for connecting to the car wiring, and it is not necessary to disconnect any leads inside of the motor frame when dropping the lower half for cleaning.

Armature.—The armature is of the well known iron clad type and is 14½ inches in diameter with a spread of 6½ inches. The core is built up of well annealed laminations and is assembled directly on the shaft. There are 33 slots and each slot contains three coils, collected together and insulated so as to form one triple coil. Hence there are 33 triple coils connected with 99 commutator bars. A small number of coils is of especial advantage when an armature has to be repaired, and the method of forming the coils into groups of three admits of substantial insulation of high quality. The insulation of the coils consists of specially prepared tape and cloth, which has high insulating qualities and is impervious to moisture. When the coils are in place on the armature core they will withstand without injury a high potential test of 2,500 volts between the windings and the core. The terminals of each coil are brought directly into the commutator segments and soldered so as to properly connect the armature coils, and at the same time form the connections between the armature windings and the commutator. The end windings are effectually protected from mechanical injury and carbon dust by the metal core heads and by a canvas dressing. The coils are held in place in the slot and on the ends by tinned steel wire bands, held together by clips and securely soldered.

Commutator and Brush Holders.—The commutator is 10 inches in diameter. Its segments are 4⅜ inches long with a wearing depth of 1 inch and are insulated from the shell by cone clamping insulations of the best quality of pressed mica. The segments are of the highest grade drawn copper of uniform hardness, and are slotted at the back for the armature leads. The mica between the segments is of a somewhat softer quality than that used in the clamping insulations, to insure an even wear with the copper segments. The completed commutator is tested by 5,000 volts between segments and shell and 500 volts between adjacent segments. Particular attention has been given to the matter of commutation, and under normal conditions the commutator will run with practically no sparking.

The brush holders of cast brass are constructed to receive two carbon brushes per holder. The brushes are 1⅜ in. x 2¼ in. x ½ in. They slide in finished ways and are held in place against the commutator by independent pressure figures, which give a uniform pressure to the brushes throughout their entire working range. The brush holders are clamped to a hard wood yoke, carefully treated with a moisture proof insulating compound. The brush holder yoke is bolted to the top magnet frame, and is so arranged that it may be removed through the opening in the frame over the commutator. All the leads from the motor to the car body are brought out through the rubber bushed holes in the magnet frame at the front of the motor, thus facilitating wiring of the car.

Suspension.—G. E. 58 motors are adapted to nose, yoke or side bar suspension. The yoke suspension is especially recommended, as the weight of the motor is carried on springs placed upon the side of the truck frame. Lugs are cast on the upper magnet frame, to which the suspension bar is bolted; the lower half may, therefore, be swung down into the pit without disturbing the upper half, which remains suspended from the axle and yoke. When the motor is mounted on 33-inch wheels, the clearance between the bottom of the motor frame and the top of the rails is 4¼ inches; the clearance between the bottom of the gear case and the top of the track is 4¼ inches. The motor without gear or gear case weighs 1,865 pounds and complete, with both gear and gear case, weighs 2,150 pounds.

Electric Railroading in Eastern Massachusetts.

Few people have an idea of the magnitude and rapid growth of electric railway traffic in Eastern Massachusetts and Rhode Island. A few facts from Derrah's Street Railway Guide, just issued, will surprise even those who are accustomed to take long rides in the electric cars. The number of miles operated by the street railways of Massachusetts and Rhode Island, included in Derrah's Guide, is 1,368.25, out of a total of 1,738.50 in both States. The number of passengers carried last year by the street railways included in the Guide was 312,000,000. These facts indicate the need of a work of this kind, and in addition to the complete tables showing routes, rates of fare, distances, etc., the edition this year contains more than 160 pages of reading matter descriptive of all the principal points of interest along lines of the street railways. This matter will be found of great value to those who make excursions on the trolley trips in summer. The volume is of a convenient size for the pocket, and is handsomely illustrated with some 90 half-tone views of places of interest. The author of the Guide has been connected with the West End Street Railway Company for the past nine years, and has made a special study of the street railways throughout New England. The Guide has the indorsement of the Massachusetts Street Railways of the State. It is published by Robert H. Derrah, 115 Devonshire Street, Boston. The price is 15 cents.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Bell Building.

Terms of Subscription.

United States, Canada and Mexico, - - - - - -	per year,	$3.00
Four or more Copies in Clubs (each), - - - - - -	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies, - - - - - - - - - - - -	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1888.*]

Vol. XXVI. NEW YORK, AUGUST 4, 1898. No. 535

Municipal Telephony in England.

AS our readers are probably aware, a good deal of evidence has been taken recently in England before a select committee of the House of Commons on the subject of "municipalizing" the telephones. It cannot be said that the evidence has revealed anything very new, although a great many witnesses have been called. The fight is a rather curious one in itself, being triangular, and not likely to occur in this country, at least not at present, although there is no telling to what lengths municipal socialism may not carry some of our citizens, such as those who denounce Tammany hotly and next moment propose to create a huge municipal railway system for Tammany's special delectation.

It will be remembered that in England the post office has a telephone monopoly and does some telephone business, but that the National Telephone Co., under a license now running to 1911, does practically the telephone exchange work of the country, even when competing against the Government. For example, in Liverpool, the post office has 14 subscribers, while the National Company has something like 10,000. Now, however, a movement has sprung up with the object of enabling the municipalities to own and operate telephone exchanges, and over this proposition the contest wages. Some of the municipalities want it, some oppose it; and the General Post Office does not favor it at all, if we follow the testimony. Mr. W. H. Preece, the well-known chief engineer of the Government Telegraphs, in his evidence, just reported, puts the official opinion in this shape: "The demand for the municipalisation of the telephones was founded on three assumptions, each of which he submitted, was erroneous, namely, that the post office was unable to give an efficient telephone service; that the National Company was unable to do so, and that the municipalities could give one both efficiently and economically." At the same time, Mr. Preece avowed his belief that the Government could compete with the National Company if the terms of competition were equalized; "whereas the National Company not only had energetic canvassers but were allowed to employ all the usual commercial means to extend their business."

Two points become very obvious in this investigation. The first is that some of the municipalities seek to intrude into a field already well covered, and one in which it would certainly be preferable to let the Government manage if the National Company is to be crowded out, a consummation devoutly to be dreaded. The other point is that the municipal plants would be purely local, and that the business of inter-connections would be confusing to the best clearing house system ever devised. You might just as well try to operate the telegraph on a local basis, without trunk lines. The proposition is so absurd it needs only to be stated to reveal all its crudity and wildness. In this country, among the greatest difficulties that the numerous independent telephone companies have to contend with is the absence of trunk lines for inter-communication, so that we see a steady movement constantly in progress to supply the deficiency on some kind of combination plan which in the long run must mean the formation of territorial operating companies such as those of the Bell system, in turn supplemented by long distance lines open to them all, on a pro rata plan of earning.

The Search-light and Electricity in the Navy.

IT is certain that one of the results of the present war with Spain will be the greater use of electricity on board men-of-war, and particularly on our own. The searchlight has assuredly proved its value. It made Cervera come out in the daytime, for, according to the confession of the Spanish officers themselves, it was no use trying to dodge the beams of light that made the exit each night brighter than it was by day. There was no dodging that insistent beam. We note that a distinguished English critic, Lieut. G. Armstrong, R. N., thinks that Admiral Cervera had a fine chance to torpedo, as "the Americans appear to have had no picket boats watching the harbor, and their ships were without nets." The splendid efficiency of the searchlights is a sufficient answer to whatever is true in that criticism.

The new battleships will have a good deal of electrical apparatus for the operation of the guns. It is now evident, we believe, that motors are the best devices for handling turrets, guns, ammunition hoists, etc. Besides, a broken wire can be spliced in a second, where a ruptured pipe could not be mended at all. The means of communication, of steering and range finding have also suggested various improvements, all of which will be studied out. Even the newer things will have their uses, some now unsuspected. It is not extremely impossible that shell before going to the guns may be X-rayed and show up any defect, for it is known that many shells were useless and the defects were necessarily within. We have heard also lately a good deal about the use of the megaphone between the ships and of ceaseless flag and lamp signaling, but not a soul has succeeded in enabling the ships to talk electrically without wires between them. Surely it is possible now to do this. If not, why do such geniuses as Edison, Tesla and Marconi live?

Avoiding Collision at Sea.

THE old saying that "When a child has fallen into a well, they think about covering it over," has again found its echo in the means suggested for avoiding collisions at sea, after the terrible accident whereby the French ocean liner Bourgogne was sunk by colliding with the Cromartyshire. Hundreds of unfortunate passengers and members of the crew of the former vessel found a watery grave, while the small number of survivors had horrible tales to tell of butchery and disgraceful scenes. This terrible catastrophe, unparalleled in the annals of modern transportation, and one which has shocked the entire civilized world, has given cause for reflection and has put judges, pessimists and inventors to work, fixing responsibility and devising means whereby a repetition may be avoided. Fortunately it is not within our sphere to pass judgment on actions as inhuman as those of which members of the Bourgogne crew or perhaps sailor passengers in the steerage are accused. But does the placing of this blame on the sailors for lack of cool-headedness and fellow-feeling exonerate the companies into whose hands the passengers entrust their lives? This is a pertinent and timely question which will have to be answered sooner or later. As the traffic on our ocean highways increases, as well as the speed and number of ships, collisions will occur, due to the elements, personal neglects and errors, and seemingly unavoidable causes. But it is for the companies to find ways and means whereby the liabilities of collisions will be reduced and to install adequate life-saving devices. To discuss all these questions minutely as each one deserves would fill volumes and is outside the province of our pages, and we will refer simply to the question of the prevention of accidents, leaving that of cure in the hands of the companies and to the judgment displayed by officers, crew and passengers at the time of the accident. While many devices have been in use on board vessels for announcing their approach to each other, some of which have proven fairly satisfactory under favorable conditions, none, judging from the frequency of mishaps, have as yet been devised which will under all conditions make the presence of one vessel known to another. This is due not so much to the transmitting devices, as to changes in the transmitting medium and inefficient receiving apparatus. The rea-

Digitized by Google

sons for this are pointed out admirably in a paper by Mr. Herrman Herberts, on another page of this issue. The author goes a step further than merely criticising the old methods, in suggesting one which appears to be both novel and worthy of careful consideration. While it has been known for years that the heat radiated from a ship might serve as an indication of its approach, using the thermopile to receive the radiations, Mr. Herberts has devised an ingenious, delicate and what appears to be a fairly reliable arrangement for the use of a thermopile in connection with a galvanometer. Two complete sets of apparatus, which would indicate the approach of an iceberg as well as of a ship, are required on board of each vessel, one at each side of it. They must be shielded from outside influences such as warm or cold currents of air and water, if such is possible, and must be carefully and nearly constantly watched during foggy weather and at night. The apparatus must be sufficiently sensitive to indicate the approach of a sailing vessel, without boilers and with few persons on board to give out such heat, as might be expected to be radiated from large ocean greyhounds. These and many more are the severe conditions imposed upon this newly devised system, which regardless of its possible limitations, deserves to be placed in the category of useful and humanitarian suggestions. Who knows but that the difficulties which now may seem to beset it, may be removed by conscientious and painstaking experimenting and diligent thought, or that it may perhaps lead in the right direction for the preservation of life and property at sea.

Gold from the Sea.

THE daily papers are full of sensational accounts of the operations of the Electrolytic Marine Salts Co. and the sudden disappearance of its vice-president, Rev. P. F. Jernegan, from the scene, with a satchel full of Government bonds into which he has converted a large amount of ready cash. It was known in this part of the world that a company was trying up in Maine to extract from the sea the gold that is reputed to exist there in about the proportion of one grain per ton of salt water, but it had not been realized that a big speculation was based on this, and that a large number of unwary people had bought stock in the enterprise all through New England. The capital was $10,000,000 in $1 shares, and of all sales of stock Mr. Jernegan was to get 45 per cent., the rest being applied to working the "invention," which was a secret. Just how much stock was actually sold does not appear, but it reached at least $1,000,000, and Mr. Jernegan's share of $338,000 is apparently what has gone to buy his wad of choice bonds. Up at North Lubec, Me., the company had a plant right on the mother lode, i. e., the Atlantic, with 240 "accumulators" at work to throw down the gold and silver. Every week a $2,000 brick of extract has come along, purporting to be the product of the plant, although it is now shrewdly suspected that one or two bricks have been playing the part of a theatrical army on the stage. When the accumulators were inspected last week after Mr. Jernegan's flight, each one was found as bare as Mrs. Hubbard's cupboard, in spite of the fact that they were rated to produce $1.25 every twenty-four hours, and did their work so miraculously well that the weekly gold brick was always about the same weight and value. The cost of production was only $300 per week.

The North Lubec works are now shut down; the thrifty New England investor is all anxiety and tears, and the air is full of wild rumors, but the Rev. F. P. Jernegan will doubtless explain everything satisfactorily when he lands, to the detectives who are waiting for him at Havre. One is reminded of the Friend Electric Sugar Refining swindle which played havoc in New York with the gullible public, and which did not even have a basis of physical data to rest upon. There are well-informed engineers who believe that if the plant were only big enough, the sea might be profitably attacked with right methods and made to yield its precious metals, as it does its salt; but it seems unlikely that Mr. Jernegan had got the approval of any authoritative expert for his work. We know that our own letters of inquiry went unanswered, and it is probable that the "secret" was never divulged to anybody.

Mr. Jernegan is said to have stated before he left that he was going to buy in Europe electrical machinery that he could not get here. It is a pity he did not specify what it was. Perhaps he was unable to do so. We do not know of any such apparatus made in Europe that is better that any made in America; and Mr. Jernegan's statement should have aroused suspicion amongst some at least of the shrewd business men whose names are mentioned as being his associates.

Even should the reverend scientist succeed in establishing his fair fame, we made bold to say that his enterprise is one more warning that people should not invest in any electrical or mining enterprise until they have secured the advice of responsible authorities, whose fee will be well worth the paying.

Women Car Conductors.

SOME weeks ago we made note of the fact that Mr. Myers at Chillicothe, Ohio, was employing women as conductors on his street cars, and was satisfied with the results. Mr. Johnson at Madison, Ind., appears to have been less happy in his experience, and it is stated that in consequence of the same experiment there, the patronage of the cars has fallen off considerably. "Merchants, landlords, and in fact all classes of citizens are protesting, and the labor organizations are leading the opposition with all their strength. In every aspect of the case the change is looked upon as an innovation that public opinion cannot and will not tolerate." The news comes also of a trial of women conductors at Vincennes, Ind., "as a matter of economy," the wages paid the girls there being $20 per month. No general disturbance appears to have resulted in Vincennes yet, but there has been, naturally, "considerable talk and some indignation on the part of old employés."

It seems hard and unfair to exclude women from any employment commensurate with their ability, but one would imagine that the rough, trying ordeal of street car running and the collection of fares from all manner and conditions of people is not quite the best work for women to choose. Of course, if all the young men in the country had gone to the war, it would appear absolutely necessary to employ young women; but the number of soldiers required to lick the Spaniards into submission is really insignificant. If the question is solely one of economy, it is certainly better to operate the road with women than have no cars at all. At Madison, public opinion has pronounced against the novelty in a severe manner, but we cannot believe that in any American community, women trying to earn an honest livelihood will be treated otherwise than with respect and civility. It will be remembered that when women entered the telegraph service there was a tremendous feeling against the innovation, but they have long ago lived down all that. In other countries where women are employed on railroads they appear to be well treated by the public and to get along pretty comfortably. It must be, after all, a matter of public opinion. If American people make up their minds that women are not desirable as employés in the traction field any more than behind saloon bars, that will settle it.

So far as we know, women have not invaded at all the field of central station work. A case was reported last April of a woman running an electric light plant at Logansport, Ind., on the sudden resignation of the engineer; but we believe it was only a temporary assignment. Yet, women are often engaged on much harder work, and much more disagreeable jobs, than can be found in a clean and neat lighting plant, where they are not under the necessity to have anything to do with the public. Perhaps it is too much like the retirement and isolation of domestic service to be inviting to women; whereas we can readily understand that for a bright, strong, good-natured girl the prospect of being always on the go upon the cars and of seeing what happens around town, with the opportunity to encounter friends or become acquainted with marriageable young men, might have many attractions in spite of low salary. As between factory life and domestic service, few girls hesitate, and we opine that most of them, if physically equal to it, would consider street car conductorship superior to both.

WE understand that Manager Naylor, of the electric light plant at Wadena, Minn., placed red and blue electric lamps on top of the water tank to give notice of the way battles were going in the war. If Spain were winner, the red lamps would be turned on; if the United States came out on top, the blue would announce the glad news. Mr. Naylor has several red lamps for sale, good as new.

IN view of the growing interest in automobiles, principally those propelled by the electric current, and the impetus which this new art has received on the other side of the Atlantic, especially in France, we print on another page a report of the recent exhibition of automobiles in Paris. This report is an abstract of a more exhaustive one by M. Hospitalier, the well-known French electrical authority.

Digitized by Google

ELECTRIC LIGHTING.

Allegheny County Light Company, Pittsburg.

THIS company was organized in 1881 and operates the only central lighting station in Pittsburg and Allegheny. In order to care for its growing business, the company has recently, after successive moves and alterations, concentrated its entire equipment in a splendid new building at Thirteenth and Etna streets, near the Allegheny River, and comparatively near ter centre of distribution (the field covering a territory ten by eight miles in extent), but even now it is engaged in replacing generators and engines that were recently thought to be up-to-date with more modern and more efficient equipment. The latest installation includes four direct coupled units, each of which consists of a Westinghouse vertical type compound condensing engine, of 2,000 nominal horse power, and a Westinghouse two-phase generator of 1,500 kilowatts capacity, equal to the 20,000 16 c. p. lamps. The armature of these machines, which are among the largest yet erected, measures 16 feet 8 inches in diameter, and weighs 40 tons, the speed being 120 revolutions per minute. The current at 2,400 volts is collected from a four ring collector which is located between the generator and the outside bearing. For the outlying districts, one of which is five miles from the station, transformers are used, the first being a step up to 5,500 volts, three-phase, and down to 2,400 two-phase. It is the intention to synchronize the machines and run them in multiple, and for this purpose dash pots are being added to the valve gear of the engines, as the single weight governor is found to be too sensitive for synchronizing properly. A duplicate set of steam pipes is provided throughout, and each valve is backed by a second to provide against possible contingencies. The valves consist of steel bodies and the flanges are of forged steel, milled and finished, making a specially tight joint. The exciting current for the field coils is obtained from three direct coupled units, consisting of Westinghouse engines and generators, two being of 75 kilowatt capacity, the other of 40 kilowatt under a voltage of 250. The cables from each machine lead directly into the basement to the resistance coil, then up to the switchboard on which the switches are operated by a pneumatic device from levers located at a safe distance from the board.

The arc light machines, of which there are 32 in this station, are of the Brush type, each of 60 light capacity. These are driven by belts from Westinghouse compound engines, three being placed in tandem to each engine. These as well as the alternating current generators are to be replaced with large units, and so equipped that they will deliver current of any required capacity. While the Brush machines are said to be out of date, it is not from any deterioration in efficiency, for even after long service they are regarded by the superintendent as efficient as when first installed. When a few of the armature bobbins have been renewed, it is the practice to re-wind all, in order to maintain the armature in perfect balance. The principal auxiliary steam equipment of the engine room consists of a Worthington high cone jet condenser of 6,000 horse power, it being one of the largest, if not the largest, condensers yet installed in a lighting station. Water for condensing purposes is derived from a well which is 12 feet in diameter and 45 feet in depth, to which the water is led through a 4-foot brick tunnel which extends from near the bottom of the well 592 feet under the bed to the channel of the river, which terminates in a filtering crib. This tunnel was recently illustrated and described in The Electrical Engineer. The engine room is also equipped by a 30-ton electric Morgan crane, which spans the structure and serves to handle any part of the machinery..

The steam generating plant consists of 16 water tube boilers of the Babcock & Wilcox type, rated at 6,000 horse power, and these are located half on each floor of the boiler room, as the boiler house is a two-story structure, heavy iron posts being provided for supporting the weight. The boilers are fed by Roney stokers, and the coal, which is hauled by carts from boats in the river, is elevated into nine ton storage tanks located on the roof of the boiler house, from which it descends by gravity to the stoker. The company has also provided a storage yard in which 3,000 tons of coal are kept on hand to provide against any emergency in case high or low water should interfere with the shipping facilities. The station consumes about 150 tons of coal per day.

The new building is of brick, fireproof, and occupies a ground space of 100 by 400 feet. The engine room is 100 by 200 feet and 34 feet in height. The walls are of white enamelled brick, while the floor is of tile, giving it a clean appearance, a condition seldom found in a Pittsburg establishment, due to the prevalence of smoke from the numerous furnaces. The same cause renders the atmosphere cloudy, which calls for electric lighting service both day and night for a good part of the year. The building contains besides the power station proper the business offices of the company, repair shops, draughting room, testing and laboratory departments, store room and an electric kitchen and dining room. In the latter, the noon day meal for the office force is served, all the food being cooked on electric kitchen appliances, from the American Electric Heating Corporation, of Boston. Electric fans located above the table provide for free circulation of air, and help to give it its name, the "Electric Dining Room." The present output of the station is 2,500 arc lights of 2,000 c. p. each, and 115,000 16 c. p. incandescent lights. Considerable current is provided for stationary motors, and during a part of the day current of 500 volts is supplied to one of the street railway systems. Among the repair tools may be noted a storage battery hand cart in which a number of cells are constantly kept charged and which is used for a lighting current when it is necessary to make repairs in the subways and manholes. This is a precaution to prevent an explosion of accumulated gas which is sometimes destructive when open lights are used. The affairs of the company are under the efficient management of Mr. G. H. Blaxter, vice-president, who is assisted by Mr. W. J. Hunker, superintendent. Mr. Hunker has been with the company almost from the start and has conducted the various transformations in the power equipment. He wonders if he will ever have the opportunity of operating a plant that is not undergoing enlargement.

TELEPHONY AND TELEGRAPHY.

Practical Features of Telephone Work.—XVIII.

BY A. E. DOBBS.

IN a former chapter on instrument specifications, preference is given to the Hunning type of transmitter, not because it is the best, for I regard it as a rather inefficient one, but because it is free from patent litigation, if any of them are, and if properly made will do good service, and needs no adjustment or repairs while in ordinary use. One of the objections to it is its high resistance, which cuts down the battery current while the mass of carbon granules is not as sensitive to slight variations as the old-fashioned Blake, so that voices cannot be so readily recognized. Were it not for the fact that on account of blackening at the contacts the use of the Blake is restricted to a single cell of battery, it would be an ideal transmitter for either short or long distance work.

The modification of the Hunning, known as the "solid back," is an improvement, but care should be taken to avoid detail patents.

One company in Marietta, Pa., cuts down the resistance of the carbon granules by plating them with gold and silver. This bi-metallic combination should make a powerful talking instrument provided that experience shows that the granules do not oxidize. In order to get the best results I should think the granules might be mixed with those of ordinary carbon in, say, equal parts.

INSTRUMENT AND LINE TROUBLES.

It is to be supposed that every lineman knows how to "hunt trouble," but one or two hints may not be amiss.

In open lines it is best to first go on the line and listen, for any telephone man who knows his instruments and lines, can tell by listening, and blowing gently on the transmitter, about how far off his trouble is, either on grounded or open lines.

Digitized by Google

Thus, in an open line, if the line is "dead," with not a particle of escape or induction coming back to the ear, he knows that the trouble is nearby, and acts accordingly. If, however, he can hear a slight inductive disturbance, he knows that it is outside of the office cables, or a quarter or half a mile away, and familiarity with the exchange and the instruments in use will enable him to guess very closely as to where the trouble is.

All lines, however, will not act in the same way. Thus, lines running through trees will act differently from those that are well insulated, and those alongside of a trolley road will be more noisy than those in other parts of the town; but practice will enable him to tell the difference.

With grounded lines the case is reversed. If the transmitter comes up loud and clear, without any induction, the trouble is nearby, and the amount of induction on the line is in proportion to the distance. This method also requires practice.

In New York City in the early days when there were hundreds of housetop fixtures, there were men so expert in this kind of a thing that they could almost walk to the block where the trouble was located, and as climbing onto six-story buildings took time, a man was judged very largely by his ability to clear trouble with the least amount of work.

What is known as "resistance trouble" is caused either by a loose connection which will be indicated by the lines opening at intervals, or by insufficient contact, which makes the conversation have a very faint, far-away sound, as when a joint is made in rusty or badly corroded wire without cleaning. To locate this trouble generally requires the services of two men, one to listen and make tests, while the other goes along the line to the points directed.

In the first place short circuit the subscriber's instrument, and if the transmitter "comes up" loud and clear, it is plain that the fault is outside. Next try another short circuit, or ground,

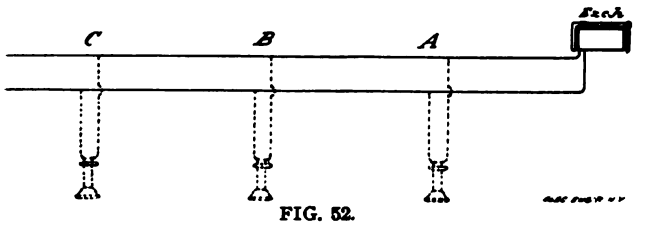


FIG. 52.

outside the subscriber's premises, and try the instrument again, which will show whether or not the house wiring is all right.

Then let the second man start, either at the exchange or the sub-instrument, as shown in Fig. 52, and move from point to point, as at A, B, C, until the trouble is located between two points, when the range may be narrowed down, meanwhile carefully examining all connections, until the bad one is found. The second man may use a telephone and listen himself, or he may merely short circuit, or ground the line, depending upon the first man for information as to results. Of course if the line is grounded or short circuited, the first man must depend upon his skill in listening, to locate the trouble.

A loose connection is sometimes hard to catch owing to the fact that it may not show up for days, then suddenly open up without warning, only to appear all right again when the trouble man tests it, and in this way keeps the office force "guessing" for a week or two.

This trouble is often found in the switch hook, and for this reason always test the instrument first.

It is also frequently found in cable and office terminals that a loose screw or unsoldered tip is the cause. It will sometimes be found in a faulty switch cord, or a dirty spring jack. It may also be found there, especially after a thunderstorm or a or in the secondary winding of the induction coil, and in some instruments where the line circuit goes through the generator shaft, it may be found from loose or dirty springs at that place.

In some switchboards where the drop is left in circuit, it may also be found there, especialy after a thunderstorm or a visitation by other foreign currents.

Therefore, while there is a chance that this trouble may be in the line, there are several chances that it may be in the instrument, switchboard, or distributing board, and these should be tested first.

In some of the new exchanges a great deal of trouble can be traced to the excessive use of fuses in the line.

In one exchange there were fuses at both cable terminals. and still another in the instrument. This, of course, protected both instruments and board very thoroughly, but the annoyance and trouble from this batch of sensitive fuses cost the company many times the price of an occasional drop.

Three fuses in the line are enough, two at the distributing board (both sides of the circuit) and one at the instrument, which should satisfy the most exacting insurance inspector and afford all needed protection. Of course, as explained in a preceding chapter, ground arresters can be placed wherever desired.

The first thing a trouble man should do is to become familiar with the instruments in use, and for testing purposes the ordinary instruments may be divided into four parts:

1st. The generator circuit. If in trouble, will not ring the exchange, though the bells can be rung from there. Remedy: Test by placing a finger and thumb on terminals nearest the armature coil, turn the handle and "feel" for current. Most magneto generators have a movable shaft which, when the handle is turned, is pushed over against a spring contact which puts the generator to line. Trouble is often found here.

2d. The ringing circuit. This includes the bells and the "down" contacts of the switch. Trouble: Does not ring, though the generator may, or may not, ring the exchange. Remedy: Open one side of the bell magnet circuit, then turn the handle and "feel" for current, placing the thumb and finger so as to shunt the bell magnets. If the current comes up all right the trouble is with the magnet spools, for it can't be anywhere else. If this test shows a strong current, place the thumb and finger in series with the spools and in this way find out whether it is an "open" or short circuit.. In some instruments the frame of the bell is connected in circuit so that another "ground" on the frame would cut the bells out and this will often be found in the wire ends joining the two spools together getting in contact with the frame. If no current, however, is obtained in this test, examine the switch contacts and test back toward the generator.

3d. The secondary circuit. This includes the secondary coil, and in most cases an up-switch contact, receiver, cord and line. Trouble: Does not talk, though it can ring the exchange or be called from there, but so far as talking or hearing is concerned, the line is "dead." Remedy: Examine the contacts, test cord, receiver and coil, till the trouble is found.

Note: In some cases the receiver is left in series with the ringing coils when the hook is down, in which case it cannot be included in this circuit, as a broken cord opens the whole line.

4th. The primary or transmitter circuit which includes the battery, the transmitter, the primary coil, and the up-switch contacts. Trouble: Can call the exchange and hear perfectly, but cannot be made to talk. Remedy: Examine carefully the battery and wires leading to the coil and transmitter. Take a hand telephone and, beginning at the battery, follow up the circuit as long as the battery clicks, until the trouble is located. Sometimes a cross between the primary and secondary coils will produce this effect.

The first and second sections of the above apply only to those instruments in which the ringer coils are in series with the line. There are other instruments with direct current instead of alternating generators, or with the ringer coils bridged across the line instead of in series.

In such a case insist on having a diagram from the manufacturer, or else take the instrument and study it till thoroughly familiar with it, following out the divisions indicated above.

Sometimes a transmitter will not talk well from having too much or too little carbon in it.

In order to test this, blow your breath gently across the edge of the mouthpiece and into the transmitter, and when the sound breaks very slightly, the transmitter is as nearly right as you will get it, and a little practice will enable you to test very accurately and rapidly. Beware of too tight an adjustment if you would get good results.

I have seen transmitters so full of granulated carbon that the only way they could be made to talk was to rest the point of the chin against the mouthpiece so that the direct vibration from the vocal organs (the chin is not exactly a vocal organ, but it is connected directly with them and vibrates when speaking) might shake up the mass.

OTHER ITEMS.

It is not a good plan to put two or more telephones in

Digitized by Google

series on a single line, as the self-induction of the magnets raises the resistance of the line to many times the measured resistance of their coils. A better plan is to buy instruments with 1,000 ohm coils and bridge in on the line, and party lines should be limited to six telephones at the outside, and four would be better still.

In cutting in an auxiliary bell, do not loop it in on the main line, as you will then have it in series when the line is in use. Instead, loop it in on the bell circuit, by bringing the wires inside the box and cutting the bell loop between the right hand binding post and bell. By doing this you will have the auxiliary bell cut out, or shunted, when the hook is up.

This rule also applies to drops used for this purpose. With bridged bells where it is thought necessary to bridge in with a 1,000 ohm auxiliary drop or bell, bring the wire inside the box and bridge across the bell loop, that is, if the bell loop is cut out during conversation.

A 100 ohm drop will generally work in series with a 1,000 ohm bell, however, as the exchange generator will easily furnish current for both.

In connecting telephones in multiple or bridged form, it is a matter of some importance that the generator is able to ring them all clearly, and the only way to do this is to connect several of them together in the shop and try them there; in this case the generator should be tried on nearly twice as many as it will have to ring in practice, in order to balance line resistance, etc.

There is many a generator that will ring one bell through 40,000 ohms resistance, which would not ring four bells in multiple through 1,000 ohms of line resistance, because while the voltage is high the quantity is very small, and it should, in this case, be tested on at least eight instruments in the back shop.

The number of bells a generator will ring depends largely upon the number and size of the magnets and the winding of the armature.

Independent Telephone Combination In Iowa.

A MOVEMENT is on foot for the consolidation of all the independent telephone toll lines in the State of Iowa, under one management, and the merging of the several companies into one big organization. Propositions for the proposed consolidation have been forwarded to the management of a number of lines with every indication that they will be accepted, and a meeting to outline the plan of consolidation will be called in Des Moines at an early date. The nucleus will probably be the Central Telephone Company of this city, says the "Leader."

The Central Telephone Company was organized by local capitalists, ostensibly to build a toll line from Des Moines to Oskaloosa, with a couple of short branches. This line is nearly completed, but now it is stated on excellent authority that a consolidation is in sight, and that the people who backed the Central are backing the new scheme and urging its consummation. There are now no less than thirty companies in the State operating independent telephone lines. These occupy small areas. Each is under a separate management, and a double toll system exists where two or more lines must be used to reach a designated point. There is also the inconvenience of connection between lines and under separate managements, and many other drawbacks to the operation of the independent lines on a basis that will enable them to compete with the old system. The Bell has the advantage that it reaches every portion of the State by its own system without double toll charges and without connections through separate exchanges. Then the independent lines are at a disadvantage in some localities because they are not connected one with the other. By a consolidation, it is claimed, all these difficulties could be overcome, and the independent people would be placed in a position to compete for all classes of business.

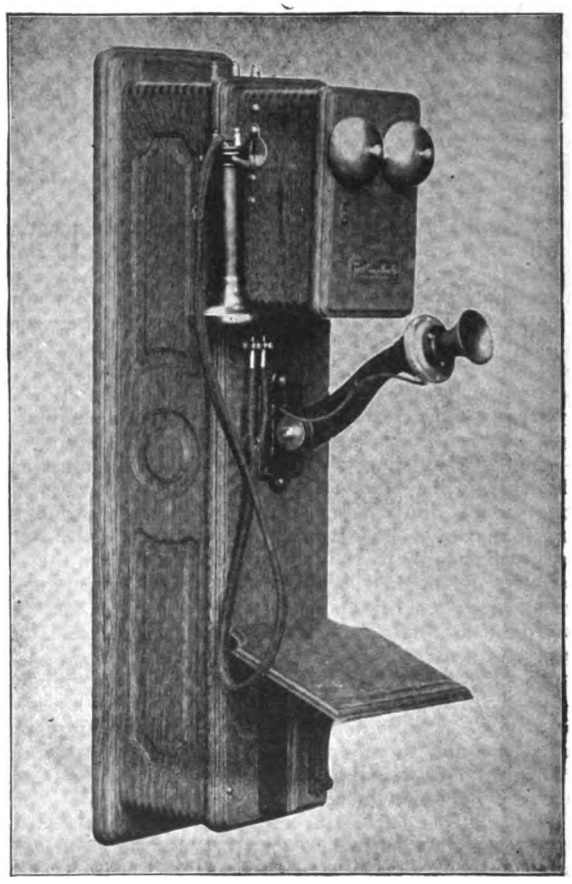
The proposition is said to be to considerably increase the capital stock of the Central or some similar organization and issue it in exchange for the stock of the other companies at a ratio to be determined by a board of appraisers to be appointed at a joint meeting of the companies who will investigate the several lines, determine what they are worth and what the volume of their toll business is and take into consideration other items relating to their worth as a portion of the consolidated system.

It is said that the independent lines now reach eighty-five out of the ninety-nine county seats in the State, and have over 1,200 toll stations, practically as many as the Bell Iowa. Many of the lines are equipped with copper metallic return circuits, others are being equipped, all of them are well built and from every point are as good as the Bell lines. If the consolidation is effected the first aim will be to secure connections with all independent telephone exchanges in the State, and ultimately to extend the lines to all the principal points, reaching the county seat towns, from which the greater volume of business is transacted, first. In the end the company may engage in the telephone exchange business and build or acquire a number of exchanges. This feature of the business is not included, however, in the proposition for consolidation, and would be a matter for future consideration, but a plan is proposed by which the new system, if it is organized, will have access to all the independent exchanges.

CANTON, S. D. The Canton Co-operative Telephone Co. started its exchange on June 28. It has a 100 drop board furnished by the American Electric Telephone Co., and 87 telephones now connected up. It is making extensions to Beloit, a distance of 2½ miles, and Beresford, 22 miles. The house rate is $1 per month, and office rate $2. The capital stock is $10,000. The officers are C. E. Judd, president; F. H. Bacon, secretary, and C. M. Sedley, treasurer.

Victor Telephone Apparatus.

THE telephone apparatus manufactured by the Victor Telephone Mfg. Co., 166-174 South Clinton street, Chicago, Ill., has been attracting a great deal of attention of late on account of its many points of efficiency. The double pole receiver made by this company, shown in the illustration, has a very powerful compound magnet fitted in a hard rubber case, and is supplied with a Victor special device for keeping the poles constantly in the same position with the diaphragm. The



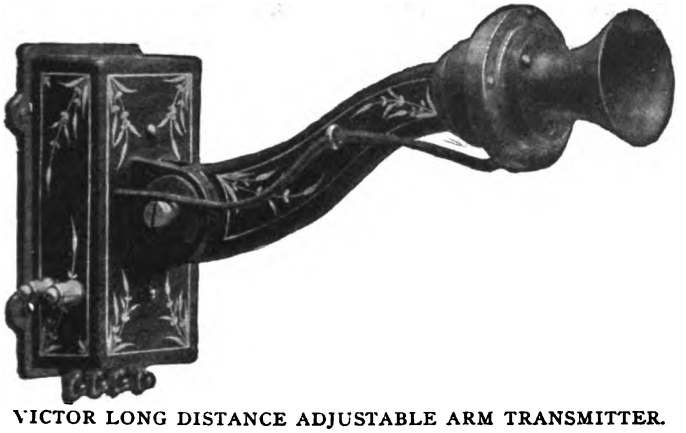
VICTOR TYPE "A" TELEPHONE SET.

magnet spools are wound with No. 36 silk-covered wire, all connections being soldered and thoroughly insulated. The long distance adjustable arm transmitter of this company, also illustrated, is of very neat design, and is superbly finished and ornamented. The transmitter head is made of hard rubber, so

Digitized by Google

as to prevent the absorption of moisture, and the consequent packing of the granules. The instrument is very sensitive, powerful and clear in articulation. A 500 ohm induction coil accompanies the instrument, of which over 10,000 are said to be in use.

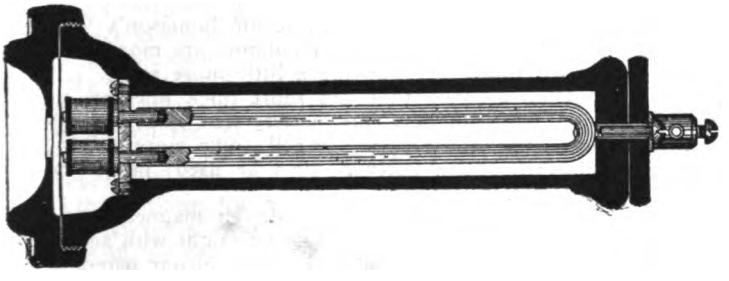
The complete outfit shown, called the Victor "A" has been especially designed for both long distance and exchange work where a strictly first-class instrument is desired. The wood-



VICTOR LONG DISTANCE ADJUSTABLE ARM TRANSMITTER.

work is quartered sawed oak, neatly carved and highly polished. The battery box is constructed to hold from one to three cells of ordinary wet battery, one above the other, doing away with the ordinary wide battery box. The generator and ringer are made of approved designs with the best material and workmanship that can be procured, and are guaranteed to give a powerful ring through 15,000 ohms resistance.

The Victor transmitter is of the long distance type and is mounted on an adjustable arm. The Victor "B" set is very similar to the "A" set just described, except that it is wired for multiple or bridging work and has a special ringer and induction coils for toll line work, for which it is specially recommended. Both these sets are supplied with the Victor double



VICTOR DOUBLE POLE RECEIVER.

pole receiver described above. The switchboard made by this company has many valuable features, such as strength, durability of parts, solidity of construction and beauty of appearance, fine workmanship, the best material, rubber insulation and soldered connections, freedom from induction and cross talk, rapidity and ease of operation, economy of maintenance, simplicity of changes and removal of parts, ease of placing bridge coils and rapid ringing device.

The "express" switchboards are straight metallic but may be used for common return wire, in five-number jack and drop self-contained sections, from which the 100 sections are built up. It is claimed that the Victor switchboards possess numerous points of superiority and merit. They are put up for either metallic or single-wire circuits in any size up to 3,000 drops.

A large number of these and other Victor telephones and boards have been installed in exchanges, factories and homes throughout the world, and have given entire satisfaction.

ASHLAND, KY.—The Lawrence Telephone Company has increased its authorized capital stock to $24,000. It has the system of the Western Telephone Construction Company, a board of 300 drops, 304 subscribers and 20 miles of toll line. The circuits are hard drawn copper and Bimetallic Company's wire. The rates for residences are $1.50 per month, and for business offices, $2. W. B. Seaton is president, J. L. Anderson, vice-president, and F. E. Hayward, secretary.

LEGAL NOTES

Important Telephone Patent Decision—The St. Louis Kellogg Switchboard.

A PATENT decision of great importance to the independent telephone movement, was rendered by Judge Showalter, of the U. S. Circuit Court at Chicago, July 29, in the case of the Western Electric Company vs. Kellogg Switchboard and Supply Company, in which the complainant sought to restrain the defendant company from installing a switchboard for the Kinloch Telephone Company of St. Louis. Judge Showalter denied the preliminary injunction asked for.

The Kinloch Telephone Company has established an exchange in St. Louis in which it has laid about 105 miles of conduit, expended over $1,000,000, has about 5,000 instruments already installed, and the switchboard will be completed and service for subscribers will commence within a short time.

The complainant applied for an injunction on the Firman patent, which expires on January 19, 1899, and the validity of which has been recently sustained by Judge De Haven, of the U. S. Circuit Court, Northern District of California, upon limited lines. The decision in California has been appealed to the U. S. Circuit Court of Appeals, and relying upon that decision, the complainant here sought to obtain an injunction and thus prevent the Kinloch Company from beginning operations, as had been planned.

It was affirmed by the affidavits of Prof. Elisha Gray, Prof. Carhart, of Michigan University; Milo G. Kellogg and F. W. Dunbar, that there was no infringement. Prof. Jackson, of the University of Wisconsin; T. D. Lockwood, C. E. Scribner and others gave affidavits to the contrary effect.

The Court stated in substance that it was his impression that there was no invention in the Firman patent; that he was unable to see upon what ground Judge De Haven had sustained the validity of the patent, in view of the prior state of the art, and especially in view of the Dumont English patent of 1851, and he advised counsel for complainant that, in his opinion, if the case went to the Circuit Court of Appeals, they would have great difficulty in sustaining that opinion.

He also stated that one of the decisions cited by Judge De Haven in his opinion had been discredited by the Circuit Court of Appeals of this Circuit in an opinion filed but a few days ago, and that it was very doubtful, to his mind, whether there was any invention in the Firman patent, or if there was invention, it was extremely doubtful if defendant infringed. He said, however, that he preferred to place his decision at this time broadly upon the principle that the Telephone Company at St. Louis was engaged in a public service; that the question was doubtful, and that the defendant Switchboard Company was undoubtedly solvent and would be able to pay any damages that might be recovered if the complainant should succeed in establishing the validity of the patent and the fact of infringement; and that it would, under such circumstances and also in view of the early expiration of the Firman patent, be an abuse of discretion for him to entertain the petition for an injunction, which he therefore denied.

The Kellogg Switchboard and Supply Company, to which we are indebted for these details, and which is a Chicago corporation, has, for about a year past, been constructing the switchboard for the Kinloch Telephone Company at Highland Park, Ill., where it has had from 150 to 200 men in its employ. The switchboard, whose construction was attempted to be enjoined, is being made under the patents of Milo G. Kellogg, of Chicago, and has a present capacity for 6,160 telephone lines and provides for an ultimate capacity of over 20,000 lines in one exchange. The largest telephone switchboard heretofore constructed has had a capacity for switching only about 6,000 telephone lines in one exchange.

ROCHESTER, N. Y. The Automatic Telephone Co. is expecting to get a franchise from the city under contract to have an exchange operating by July 1, 1899, with 1,000 subscribers, the flat rate being $48 per year.

Digitized by Google

SOCIETY & CLUB NOTES

American Electro-Therapeutic Association.

The eighth annual meeting of this body is to be held at the Public Library, Buffalo, Sept. 13, 14 and 15, with headquarters at the Hotel Iroquois. A good programme and a good exhibit of apparatus are promised. Dr. W. J. Morton is to deliver a special lecture on X-ray work.

A. A. A. S. and S. P. E. E.

The meetings of the American Association for the Advancement of Science and of the Society for the Promotion of Engineering Education will take place at Boston this month, both at the Massachusetts Institute of Technology. The Association holds its meetings during the week from August 20 to 27, when a number of interesting papers on physics and electrics will be presented. The Society will meet August 18, 19 and 20, when several papers will be read by men well known in the electrical field.

MERCHANTS' ASSOCIATION OF NEW YORK has just issued at a cost of $8,000, and is distributing by mail, 150,000 copies of a very pretty and useful booklet entitled "Summer Days and Nights in New York." The object of the book is to direct attention to the facilities of New York as a market and to its many charms as a resort with the Atlantic beaches in its front yard. The Association hopes to secure further membership among merchants, and its officers deserve much encouragement in their efforts to advance the prosperity of Greater New York.

PERSONAL

Mr. A. J. Churchward.

The Fort Wayne Electric Corporation has been successful in securing the services of Mr. A. J. Churchward, so long connected with the Excelsior Company as electrical engineer. Mr. Churchward is generally known throughout the United States for his great success with single phase alternating motors, and rotary transformers. His latest patented device is a unique brush holder which the Government has adopted as standard. The Fort Wayne people are to be congratulated. It is understood so soon as their new factory is completed, they will enter extensively into transmission work.

MR. E. M. SMILES, formerly with Mr. Edison as an X-ray expert, has opened offices at the Townsend Building, Broadway and Twenty-fifth street. He has had a large and unusually varied experience in this field, and is on the lookout for work of special difficulty and interest.

MR. A. J. MATHESON, proprietor of the Marlboro Wholesale Grocery, Bennettville, S. C., has gone in heavily for the use of telephony as an adjunct to his business and in reaching his plantations, with a central office at Blenheim. The Matheson Telephone Co., has about 50 miles of line in use and will put up more. Its switchboard, etc., was furnished by the American Electric Telephone Co. of Chicago.

MR. CARL MODREGGER, E.E., of the firm of Siemens & Halske, Vienna, is on a visit to this country investigating American electrical apparatus, plants and methods.

MR. F. W. PECK, of Chicago, has been appointed U. S. Commissioner General for the Paris Exposition of 1900. He is establishing his headquarters at the Auditorium, Chicago, and will open offices also in New York and Paris; the assistant commisisoner general taking charge probably of the New York office.

MR. THEODORE WATERS has in the August issue of the "Home Magazine" an interesting illustrated popular article descriptive of the use made in this country electrically of great water powers for transmission purposes.

MR. J. W. LIEB, JR., General Manager of the New York Edison Company, was until lately president of the Stevens Institute Alumni Association, and has now been elected alumni trustee of the institute by the Board of Trustees.

LETTERS TO THE EDITOR

Mr. Tanner on Conventional Electrical Diagrams.

WITH regard to the present discussion of appropriate electrical diagrams, Mr. D. W. C. Tanner, of Chicago, has addressed the subjoined interesting letter to Mr. T. W. Grier, chairman of the Committee on Diagrams of the Chicago Electrical Association:

I have your favor of recent date calling my attention to an article on the subject of Conventional Electrical Diagrams which appeared in The Electrical Engineer for July 14, and in other technical journals, and in which Professor Andrew Jamieson, of London, suggests a number of modifications in the diagrams which were adopted by the Chicago Electrical Association and published by that body in pamphlet form.

When first preparing a paper on the subject, and subsequently, as chairman of the association's committee, one of the first and greatest difficulties I encountered was that of selecting diagrams which would meet the approval of a majority of users. It was impossible to please everyone. Nearly all of the modifications suggested by Professor Jamieson were carefully considered by the committee, and gave place to others which were subsequently formally adopted by the association, the reasons for such action being chiefly as follows:

Field magnet coils and other helices were represented by zig-zag lines instead of a succession of curls, because the zig-zag lines are more easily drawn, and, when associated with the conventional symbol for a commutator and brushes, or with a core, would never be mistaken for non-inductive resistances.

It seems to me that, with the association's symbol for a motor generator if it were shown as connected in circuit, less confusion of lines would result than if Professor Jamieson's form were substituted, because the two commutators are more separate and distinct, although occupying a little more space.

The usual alternate long thin and short thick lines are so universally used for a simple voltaic battery that when it is required to indicate positively a storage cell, some more striking distinction than the mere letter S must be used; hence our enclosing rectangle.

The suggestion as to the constantly driven magneto generator is, as it seems to me, a good one, and might with advantage be adopted, although the symbol shown in our pamphlet is more commonly used in this country.

It was thought, when selecting symbols for ammeters, voltmeters, wattmeters and galvanometers, that the forms adopted were desirable because they were more distinct from one another than those recommended by Professor Jamieson. There is, of course, room for a difference of opinion here.

Regarding the solenoid, I am unable to see how it can adequately be represented without showing its core; how can a solenoid do any work if there is nothing to be attracted?

If there were any diagrams for which the committee expected general approval, they were those representing a voltaic battery and a "ground;" yet it seems that the latter, at least, is the subject of objection. I can only say that the use of the association's symbol is so general that a defense of it is hardly needed.

Professor Jamieson's suggestion as to individual arc lamps seems a good one; indeed, such a symbol was among those which I recommended to the association in my paper, and it is printed in connection therewith in The Electrical Engineer for February 3, 1897. The telegraph key suggested is also a good one, and is widely used, as is the very similar one shown in the association's pamphlet. A different opinion may, however, be held as to incandescent lamp and fuse.

In conclusion I can only repeat that it is difficult to please everyone; but that with the exceptions above noted, the diagrams adopted by the Chicago Electrical Association seem to me to be fair examples of those used in the best American en-

Digitized by Google

gineering practice. It is gratifying to note the interest which has been manifested in the work of the association, and our thanks are due Professor Jamieson for some valuable hints, which may guide future work along this line.

HANDBUCH DER ELEKTRISCHEN ACCUMULATOREN. (Handbook of Electric Accumulators.) By Dr. Paul Schoop. Ferdinand Enke, Stuttgart, 1898; 514 pages; 6 x 9 inches; 193 illustrations; paper. Price, $4.80.

THE literature of the electric accumulator which has thus far appeared in book form is not very extensive, and the books which are available are without exception limited in their scope. Thus we have on one hand, works devoted almost exclusively to the description of accumulators old and new, good and bad, while there are a few that have attempted to give the practical side of accumulator work, with but scant attention to the construction of the batteries themselves. Dr. Schoop's handbook is got up on an entirely different plan. His object has been to present to the reader the actual conditions existing at the present time, both as to the types of accumulators and their methods of manufacture, and as to the methods of handling them. In doing this he has not pretended to give a full description of all the accumulators thus far actually constructed, while on the other hand he has thought it advisable for his purpose to cite numerous fundamental patents bearing on accumulators, deemed worthy of mention to help furnish a clear idea of the state of the art.

The work begins with a critical discussion of the raw materials entering into the construction of storage batteries, such as lead, antimony, oxide of lead, sulphuric acid, water, etc. Dr. Schoop insists, and with a good deal of truth, that grievous sins of omission have been committed in this direction. He does not, however, content himself by the mere enumeration of the tests which the raw material ought to undergo, but in every instance gives the method of test, thus affording a safeguard for the storage battery manufacturer and user as well.

He then takes up the manufacture of the grids, showing the details, such as casting, pressing, cleaning, etc., with a special chapter on the method of carrying or holding the active material. In this we note all the principal types of grids used and proposed, the illustrations being drawn to scale, as, indeed, are all the working drawings throughout the book.

Under the chapter devoted to "active material," Dr. Schoop gives in full the mixtures employed, and the method of their preparation, including a description of the machines employed for this purpose, together with the precautions which must be taken in order to insure success in practice. To this is added a chapter on the forming of the plates, together with complete descriptions and diagrammatical representation of switchboard arrangements, etc. A short chapter is also devoted to the discussion of electrodes with porous partitions as well as the gelatinous electrolyte of silicate of soda; all these being given in detail. The methods of transporting and setting up accumulators have not been overlooked, and, indeed, this part of accumulator work is well deserving of careful attention. To this are added chapters on portable accumulators and storage battery accessories.

Under Chapter X the author discusses the capacity, efficiency and resistance of lead accumulators, and gives the results obtained by various authorities. Quite a large amount of space is devoted to an investigation carried on by the author and another, of the relative capacities, etc., of various accumulators put through actual tests. These were very carefully executed and the methods are so fully described that they may well be taken as a guide for others undertaking similar work. In the chapter devoted to the theoretical discussion of the electrochemical action which takes place in lead accumulators, the author has sought to give the most generally accepted theory on this point, as well as the special viewpoints taken by various investigators. The work closes with a chapter describing a variety of reversible galvanic combinations other than those of lead batteries, such as the zinc accumulator, the iron accumulator, etc.

Taken as a whole, the work is the most elaborate and far-reaching of its kind which has thus far come under our notice.

Dr. Schoop has evidently made the storage battery the subject of long and accurate research, but while giving his own conclusions, the full details presented upon which these conclusions are based permit the reader to form his individual estimate. The wealth of detail and illustrations throughout the work gives it a practical character, missing, as a rule, in works which enter so deeply into the causes of things as does this of Dr. Schoop's. We can heartily recommend it to all engaged in storage battery work, whether as makers or as users.

To Change the Axis of the Earth and Freeze Out Spain.

WHAT appears to be the largest electrical installation ever contemplated and which has for its object not only the revolutionizing of the earth, but even the turning of it, has been carefully worked out by Mr. Newton Harrison, E. E., editor of the "Electrical Age," and was published in a recent number of the New York "World." In the words of Mr. Harrison, whose imaginative powers seem to be equal if not superior to those of Jules Verne: "I would girdle the earth with a giant cable. Through this I would send a current of electricity strong enough to overcome the present magnetic poles of the earth. This would give us a new north pole and a new south pole. The effect of this would be to transform the earth into a huge electromagnet of such tremendous power that it would tend to lean violently toward the sun, because the sun's chief constituent is iron."

He goes on telling us of the new positions of the continents and how Spain would have to yield or die of frost. The total cost of establishing the plant he figured out to be $146,000,000,000 and the time required to complete the work 10 years. The cable is to consist of ten strands, each 12 inches in diameter, its length is 25,000 miles and its weight 264,000,000 tons. The current required would be 1,000,000 amperes, and the pressure 10,000,000 volts. The attractive force of the coil he figured out to be 58,000,000,000 pounds, and the power required 13,000,000,000 h. p.

The scheme seems certainly feasible, and there would not be the slightest trouble in raising the money. But Mr. Harrison wants too much time for the work.

Rapid Electric Conduit Laying.

THE marvelously quick electric railway construction work of the Metropolitan Street Railway Co. of New York within the last few years seems to have been equaled or even surpassed recently by the Knickerbocker Construction Co. in laying a mile of conduit for the Amsterdam Electric Light, Heat & Power Company of Brooklyn. The contract was awarded to the Knickerbocker Construction Co. of New York City on May 14, 1898, and it was provided that the work should be completed by June 14, 1898. The work was begun on June 1, 1898. The line of proposed work began at Bedford avenue and South Fourth street, and continued to Grand street, and from Berry to Union avenue on the south side of Grand. The specifications required 3 inches of concrete to be placed on bottom, top and sides of the McRoy conduits. Concrete was composed of five barrels 1-inch trap rock and two barrels sharp sand and one barrel Portland cement. The plans showed the depth of excavation to be 34 inches, but it was necessary for almost the entire distance to excavate to a depth of 4 and 5 feet to avoid the pipe of other companies. In many instances it was almost an impossibility to find room for the manholes, which were placed at all street corners. The interests of the company were looked after by Mr. C. W. LeCault, the company's superintendent. Mr. James Pilkington, president of the Knickerbocker Construction Co., personally superintended the construction. Mr. John Edgington was the city inspector. Mr. Pilkington had an average of forty-eight laborers and two foremen at work, and completed

Digitized by Google

the entire work in fourteen working days, repaved the street and removed all waste material. The surplus material was carted away as fast as it was taken from the trenches, and for that reason storekeepers and pedestrians were less annoyed than on other work of like character. The streets were paved as fast as the conduits were placed in the trenches, refilled and rammed.

Flag Raising at the Works of the Fort Wayne Electric Corporation.

PATRIOTISM and good feeling must have run high on the evening of July 16, when the employés of the Fort Wayne Electric Corporation of Fort Wayne, Ind., raised the largest flag and dedicated the largest pole and equipment in the State of Indiana, at the factory of the corporation. Long before the opening of the program a crowd of 15,000 people were assembled about the works. The electrical display was a grand one. Searchlights illuminated all the nooks in the neighborhood and by the rays thrown over the crowd its size could be seen. Connecting the office and factory buildings was a large arch made of incandescent lamps. The words "Fort Wayne" were worked out in large letters. Up on the north side of the main building was a small light and under it hung the effigy of a Spaniard.

Mr. E. A. Barnes, acting superintendent of the works, made the presentation speech in the name of the employés, and Mr. J. J. Wood, the electrician and general superintendent, accepted the flag for the corporation, in the absence of Mr. R. T. McDonald. Mr. Barnes, in presenting the emblem, made many remarks flattering to the company and its officers, and very hearty was the response of Mr. Wood. After a few appropriate remarks by Mr. E. H. Worden, Judge R. S. Taylor delivered a stirring patriotic address, in the course of which he said: "The time has come for a new development. The employés of the Fort Wayne Electric Corporation want to sell dynamos around the world. Where the flag goes ships will go, and where the ships go there will go Fort Wayne dynamos. It means larger markets, more work, more prosperity and more happiness if we learn how to utilize it."

The flag equipment, which is now the proud possession of the corporation, is erected on the northwest corner of the factory where the walls are of sufficient strength to withstand the strain. The pole, eagle and flag in position have an aggregate weight of 3,500 pounds. The pole is clamped to the corner of the building with heavy wrought iron clamps, and its construction is unique, the centre being composed of wrought iron pipe varying from 4½ inches in diameter at the base to 1 5-16 inches in diameter at the top. This pipe not only acts as the backbone of the pole, but at its lower end is connected to earth so as to form a lightning rod. It also has running through its center the copper conductors which furnish current to the lights suspended from the eagle's beak.

The golden eagle which surmounts the pole is also unique in arrangement, standing as it does on a 12-inch sphere and holding in its beak a 6-inch golden ball from which project the national colors composed of three red, white and blue 50-candle power electric lamps. The eagle and its equipment weighs 50 pounds, stands 6 feet high, has a spread of 6 feet 6 inches from tip to tip, and stands 150 feet above the sidewalk.

The flag is 54 feet 6 inches long and 32 feet 6 inches wide. The stripes are each 2 feet 6 inches wide, while the total weight of bunting used in its construction is 60 pounds.

Niagara Electrical Engineers in the War.

Captain Alfred E. Hunt, president of the Pittsburg Reduction Company, is a member of Battery B of Pennsylvania, which has been ordered to Porto Rico. Electrical and engineering circles at Niagara Falls are centered in their interest in the doings of the 1st Regiment Volunteer Engineers, to which orders have been given to leave for Porto Rico on Wednesday, August 3. In this regiment are several well known electricians who enlisted in the 42d Separate Company at Niagara Falls and went from there to Camp Black, the company being now at Camp Alger, and known as Company E of the 3d Provisional Regiment. Among the men who thus started for the front were J. R. Haskins, Francis M. Blacklock and William Hopkins. Soon after reaching Camp Black they were transferred to Camp Townsend, where Messrs. Haskins and Hopkins received commissions as Lieutenants and Mr. Blacklock was made a Sergeant. Lieutenant Haskins was formerly with the Niagara Falls Power Company, and Lieutenant Hopkins with the Carborundum Company. Sergt. Blacklock was also with the Niagara Falls Power Company. James Elliott Hewes is also a member of the 1st Regiment Volunteer Engineers, and ranks as Lieutenant. He is from the Falls, where he was connected with the Carbide Company. Still another Niagara Falls man is Archibald R. Livingstone, who nolds a Lieutenant's commission. He was connected with the wheel-pit extension work. Corp. Edwin J. Murray, of this regiment, is a son of Sheldon T. Murray, who is the superintendent of the Niagara Falls Water Works Company, one of the allied companies of the Niagara Falls Power Company. Mr. Murray was on the engineering force of the Cataract Construction Company at the Falls.

Sixty-Foot Rails for B. and O.

The receivers of the Baltimore & Ohio Railroad have purchased forty miles of 85-pound sixty-foot steel rails, and will experiment with them on the Pittsburg Division, and in the Baltimore tunnel. These rails were originally bought for the Columbia & Maryland Electric Railroad, which was designed to parallel the Baltimore & Ohio Railroad between Baltimore and Washington, and to become an important factor in business between those points. The project failed, and the material which was purchased has been sold.

EDUCATIONAL

McGill University.

THE announcement of the Faculty of Applied Science of McGill University for the session 1898-99 has been received and gives a detailed description of the various courses taught in this well known university. The electrical engineering course, for which at the present time the Faculty is endeavoring to fill the chair of the McDonald Professorship of Electrical Engineering, appears to be a thoroughly practical one, in which the most careful attention is given to strictly technical details. The University is supplied with well equipped laboratories and shops, which have recently been enlarged with the aid of generous donations; and the coming year will certainly be one of prosperity for this modern institution.

THE STOCK MARKET

Peace Prospects.

This country appears to be now within measurable distance of peace with Spain, and there is an immediate better feeling. The country comes out of war with enhanced prestige in many ways, and besides having set Cuba free, finds a hearty welcome as ruler in Porto Rico, and in such parts of the Far East as it may be found expedient to retain. There is improvement in the iron and steel industry, the outlook for very large crops is bright, and the fall trade opens up well, especially out West. Bank clearings were 28 per cent. larger than in the week of 1896, while failures fell off from 259 to 189. Gold imports are beginning, a sign of our unusually small imports of goods and our enormous trade balance.

During the past week, 13,178 shares of Western Union were sold, from 92⅞ up to 93⅜. Of General Electric, 6,442 shares were sold, around 39⅝. In Boston, Am. Bell Telephone closed the week at 278½, the rise being attributed to the sustaining of the Carty "bridging bell" patent. N. Y. Edison sold at 131.

Digitized by Google

TRADE NOTES AND NOVELTIES

The Franklin Electric Supply House, Philadelphia.

Mr. H. P. Feister.

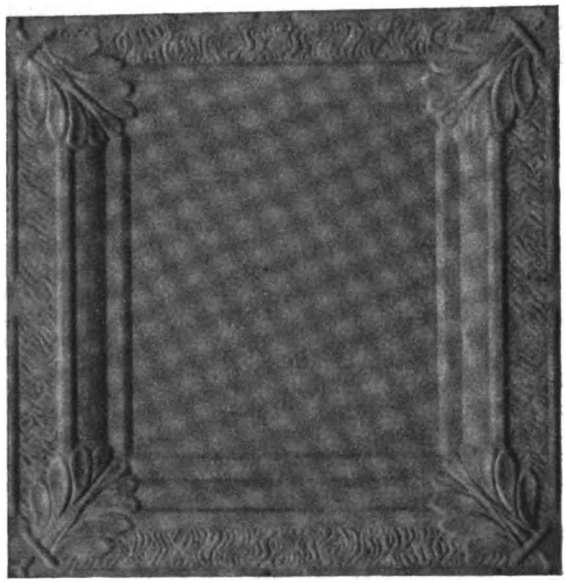
The importance of Philadelphia as one of the leading centres of electrical trade in this country bids fair to be considerably enhanced by the establishment of the enterprise which is to be known as the Franklin Electric Supply House. In resources, facilities and lines represented it will be remarkably strong, and the spirit which has carried its proprietor to pronounced success in other fields may be expected to make itself felt in this new one also. Mr. H. P. Feister, who has organized the enterprise as its proprietor is well known in the machinery world and has long been engaged in the production and sale of printing presses embodying his own inventions and improvements. He early saw the adaptability of the electric motor to such work as operating presses, and has installed large numbers in connection with his own machines. Becoming thus intimately acquainted with electrical apparatus and possibilities, and being further a man of great energy and resource, he has determined to develop his ideas also along electrical lines, with the aid of a first class staff and starting out with popular and standard lines of supplies. Special attention will be paid to electric lighting, power work and telephony, but no branch of the now great electrical supply industry will be neglected. Among the lines taken up by the Franklin warehouse as wholesalers and jobbers are the following: Commercial Electric Co., dynamos and motors; Highland Electro Chemical Mfg. Co., Highland soldering paste; W. S. Hill Electric Co., switches and switchboards; Ohio Electric Specialty Mfg. Co., automatic motor starters, commutator lubricant, perfection brushes, woven wire brushes and leaf copper brushes; Riley Bros., magic lanterns,

THE FRANKLIN ELECTRIC SUPPLY HOUSE, PHILADELPHIA.

stereopticons and kineoptoscopes; McNamara Bros., slate and marble for all purposes; Schmidt & Bruckner, 20th Century telephones; Prismatic Electric Sign Co., prismatic electric signs; D. L. Bates & Bro., fan motors, etc.; Oshkosh Logging Tool Co., electrical construction tools; John Rauscher, push buttons, the Franklin incandescent lamp, American burners, Chapman voltage regulator and Crefeld wires and cables. It will be seen that this is a very comprehensive and representative list. Mr. Feister's staff will be an excellent one, including a number of well known electrical men. The warehouse itself is a fine commodious building, located at 506 and 508 North street, now called Cuthbert street, opposite Christ Churchyard, at Fifth and Arch streets, a bare block from the tomb of the great electrician whose name it bears. The proprietor and salesmen will be glad to receive the calls there of old friends and new, and will either send representatives to parties desiring quotations or will furnish prices, etc., by mail. They believe they can offer inducements that it will not be possible to resist in the way of advantageous trading.

Stamped Metal and Cornice Work of J. H. Eller & Co., Canton, Ohio.

IT is seldom that art and utility are found so harmoniously combined, in the products of a manufacturing establishment, as in the articles produced from the works of this company. Stamped metal work is the broad term under which the output of this establishment is comprised, but it conveys only a faint idea of the variety of uses and designs to which sheet steel lends itself, when manipulated by such genius and skill as characterizes the management of this company. Skilled artists are employed for designing and the company can supply anything in this line of work, for there is no limit to the special designs that can be made from a combination of classic forms by the substitution of different fillers and moldings and a proper arrangement of different sets of panels. The designs are first all modeled in clay and from these plaster casts are made which are preserved and used as patterns. From these patterns zinc or



ORNAMENTAL METAL WORK, MANUFACTURED BY ELLER & CO., CANTON, OHIO.

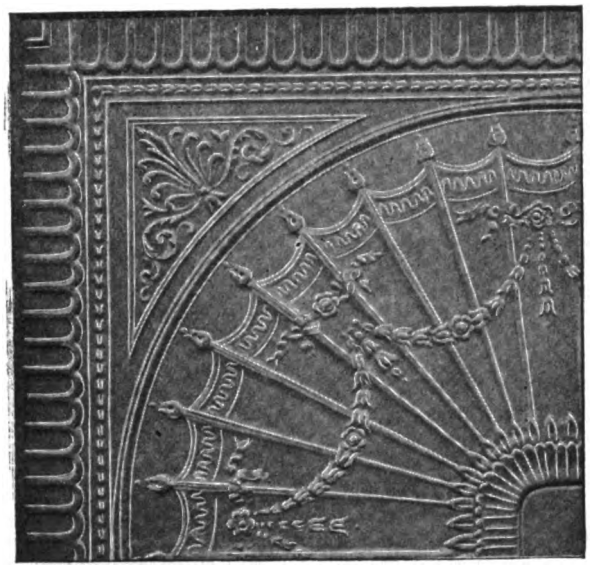
steel dies are cast. Zinc is most commonly used and the dies are made very thick. The stamping is done in drop hammers, one of the dies being placed on the anvil and the other in the face of the drop. Each panel receives three or four blows and the sheets are passed in very rapidly one after another. After being stamped, panels are retrimmed either on band saws or shears to insure accurate and close-fitting joints when in place. For stamping panels and metal ornaments for cornice work, five drop hammers are employed with an accompaniment of saws and trimming tools. These are all located in the basement of the building and are operated by electric power.

Cornices are made either of galvanized sheet plate or of copper, the former metal being mostly employed. The designs in cornices are about as numerous as for ceiling panels, and call for artistic skill of a high order. One would need to study the handsome catalogue sent out by this firm in order to form any sort of an idea of the range and character of this work. The output includes not only spun metal balls, but also balusters, urns and lamp reflectors. Besides these forms which are allied to the galvanized cornice, there are letters, and moldings for gable ornaments; also finials and weathervanes in great variety,

Digitized by Google

besides ventilators, skylight frames, ornamental crestings, ridges and chimney caps.

Roofing and Sheeting.—Both painted and galvanized sheets are employed for this purpose. No galvanizing is done by the company, however, but the black sheets are painted for roof work, and for this purpose a number of paint grinding machines are provided, in which the iron oxide or metallic base is ground in pure linseed oil and is applied to the plates by means of rollers, one of which dips into a vat of paint, and through which the sheets are passed rapidly and then placed on racks for drying. For roll roofing, the sheets after being painted are united in strips by means of a flexible double lock cross-seam, a specialty with this firm. For this purpose a special machine is provided on which the ends of the sheets are double folded and are then locked by being slid in place sideways. The sheets are then rolled into 50-foot lengths, and in the process of rolling, which is done by hand power, as each cross-seam comes under a press or groover in passing on the roll, the operator by means of a foot lever causes the die to descend, which presses the cross-seam flat and tight. The rolls of material are then wrapped in paper, and securely tied with wire for shipment. Roofing tools are provided by the company either for applying their pressed standing seam anchor-cap or lock-seam roofing. The company also make crimped edge and three crimped sheets of both painted and galvanized steel. The same material is also corrugated to different depths for roofing, siding and awnings, and this is done in presses instead of on rolls, as is usually the case. By the stamping process the metal is said to be left more uniform and better for making laps. The corrugating press is a large machine capable of crimping plates 10 feet in length and the dies are actuated by means of a series of five toggle joints and is run by an electric motor, as are several other of the finishing and stamping machines. The curved corrugated sheets are arched lengthways to any radius by passing them through a set of rolls which are beaded to fit the corrugation. The material is also pressed to imitate ordinary board siding, pressed brick, or rock-faced brick and stone, either in blocks or continuous and cluster tiles and shingles and cluster shingle siding. The claims for siding of this kind are that it is fireproof, ornamental, and can be put up for a small part of the cost of brick or stone walls..



METAL CEILING MADE BY ELLER & CO., CANTON, OHIO.

A large part of the output of the works consists of galvanized steel eave troughs and conductor pipes, the latter being either corrugated, round or square. Suitable hangers are also made of two patterns, one of stamped metal and the other of galvanized wire, twisted. This department is equipped with a full line of machinery for shearing and bending, beading and corrugating. The eave troughs are made in 10-foot lengths without seams and in five sizes, ranging from 13½ inches up to 8 inches, and are usually made of No. 28 gauge metal. The troughs are made with single or double bead, but are usually single and with an improved slip joint that requires no soldering and is not affected by expansion. The conductors are also made in 10-foot lengths without cross-seams and are corrugated after being rolled round, by placing the pipe over a mandrel having grooves throughout the whole length when the corrugations are formed by means of small wheels which register with corrugations in the mandrel and being mounted in a sliding head are actuated back and forth by means of a sprocket chain that runs over reversing pulleys at each end. These are operated rapidly and have a capacity for corrugating several thousand feet of pipe per day. The work in this department includes conductor strainers and heads; also "Safety" lock-lever cut-offs. Elbows and shoes are purchased from other parties.

Oil Cans.—In this department two types of oil cans are manufactured, one of glass known as the "Leader," the other of galvanized metal and known as the "Canton." The former is made in one gallon size only and consists of a glass cup protected by an ornamental tinned wire jacket with bands at top and bottom. The "Canton" is made in one and two gallon sizes with spouts, three and five gallon sizes, either with a faucet or spout. A large department on the third floor is devoted to this branch of the business, and is provided with numerous soldering furnaces in which the fuel is gasolene. The cans are all tested for leakage before shipment by means of air pressure, the can being immersed in a tank of water so that the slightest leak is detected by the escaping bubbles.

The works occupy a three-story frame building 150 x 200 feet, located on Tuscaras street and the Fort Wayne Railway. The office and draughting room occupy part of the first and second floors, fronting on East Fifth street. Shipping facilities are excellent and the product goes to all regions. This company makes a specialty of supplying cornice, skylights, metal ceiling and ornamental work for large buildings, and they have recently secured several large contracts for material of that kind. Mr. J. H. Eller is sole proprietor of the business.

The Williams Electric Co., Cleveland, O.

THIS is comparatively a new company, but enters the field with a manager who has had long experience in the manufacture of telephone supplies, especially magneto bells. Its principal product at present is confined to magneto bells and telephone receivers. These specialties have many points to recommend them, being developed in every direction beyond the ordinary devices that bear the same name. Some of the special features of the bells are shown in the accompanying illustration:

Fig. 1 is an illustration of the generator, showing a full front view. The magnets are held on to the pole-pieces by brass bolts, and the arrangement is such, that there is no space between the central and the outer magnets, so as to utilize all of the space on the pole-pieces that is radially adjacent to the armature. There is also a very perfect and ingenious method of taking the magnetism from the permanent magnets, and distrib-

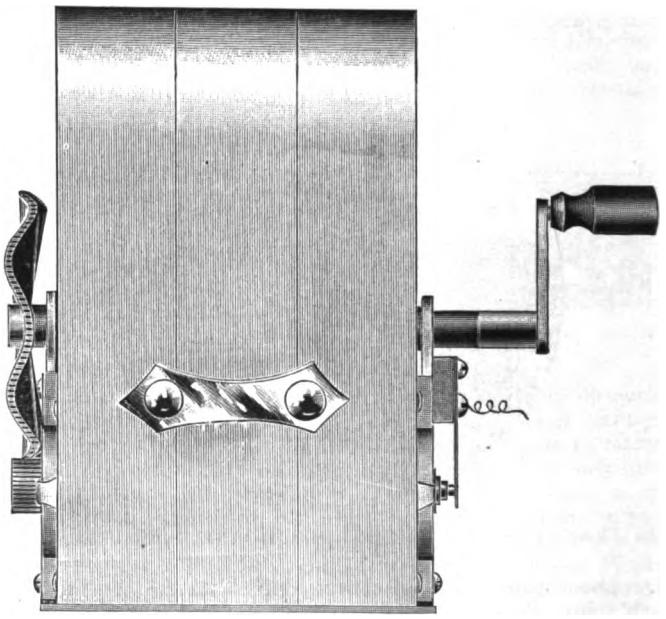


FIG. 1—WILLIAMS MAGNETO GENERATOR.

Digitized by Google

uting it uniformly around the cylindrical surface of the pole-pieces, by means of contact plates that are illustrated in Fig. 2.

Each contact plate has two ears turned inwardly to hold it in position on the pole-piece, and has, also, four ears turned outwardly to hold the permanent magnets rigidly in their proper place on the generator.

Three portions of this contact plate are left flat or straight, so as to make a good contact surface on the permanent magnets, and two portions are formed so as to make curves coincident with the outside curvature of the pole-pieces. This arrangement not only gives perfect contact between the permanent magnets and pole-pieces, but also takes the magnetism from the permanent magnets, at or about a horizontal line bisecting the armature circle. The advantage thus gained is, that instead of short-circuiting the permanent magnets, by allowing

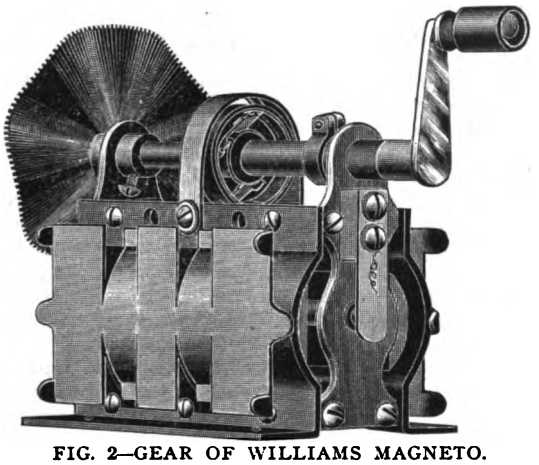


FIG. 2—GEAR OF WILLIAMS MAGNETO.

the pole-pieces to make contact at a higher point, a considerable longer length of permanent magnetism is utilized to drive the magnetism through the armature, instead of being given up entirely to the one purpose of making contacts. In this way a better contact is obtained than in the old way, and at the same time a greater effective length of permanent magnets.

The end plates which hold the shaft bearings, are punched from heavy brass, and have riveted into them very long brass bearings, which is a very important feature toward making the machine run quietly for a long period of time. These end plates are practically self-centering, so that the armature can be shifted and held centrally in the curvature of the pole-pieces, so as to prevent the armature wings from striking. This feature is important when it comes to making repairs on the generator, for one is enabled to take this machine apart and repair the winding, and reassemble it without the use of any special tools or appliances, and with but little trouble.

This machine is equipped with a very reliable clutch form of automatic shunt, or cut-out, which, by reason of its simplicity of construction, is not liable to get out of order. The driving gear is of novel construction, and is placed on the left-hand side of the generator so as to avoid unequal wear on the gear bearings, caused by turning the crank. This feature entirely obviates the disagreeable noise caused by the unequal wear of the gear bearings, due to operating the crank, and the proper centre distance between the gear shafts is maintained indefinitely.

The gear is made from a brass punching, which is radially corrugated, the object of which is to provide a driving gear that will distribute its tooth surface over the tooth surface of the pinion in an absolutely uniform manner. This gear—paradoxical though it may seem—will, it is said, not only last longer, but will run quieter during its life, than will a wide face cast cut gear, for the following reasons: Owing to the exact equality of the tooth surface of both the gear and pinion, the wear on each of them will be precisely the same, in spite of the difference in their diametrical sizes, as will be seen at a glance, from the illustration. This novel feature produces an exactly uniform rate of wear on all of the surface of all the teeth on both the gear and pinion. The effect of wearing at the same rate will maintain to a greater extent the proper curves of the teeth, of both the generator and pinion, causing them to roll one upon the other, instead of sliding and grating, as would be the case with the wide-faced gear, whose companion pinion wears more rapidly than the gear.

The pinion is attached to the armature shaft, by means of a key and a machine screw, and can be instantly taken off and replaced without having to be driven off or on, as is the case of many forms of generators heretofore constructed. This little feature is of great convenience when repairs are necessary. The object of the designers of this instrument has been to construct a magneto bell that would last indefinitely, with but few repairs, and so constructed that all necessary repairs can be made with the slightest possible loss of time or cost of material.

The resulting wave of current of this generator, due to the peculiar construction of the pole-pieces, approaches very closely the sinusoidal form, and is very useful in transmitting signals over long, leaky lines, having a high coefficient of self-induction or static capacity, thus making this instrument ideal for toll line work.

The ringer, as will be seen from Fig. 3, is a decidedly new departure. It has but a single core, which is parallel with the vibrating armature. The core head or end pieces are formed up of Swedish iron, and are swaged on to the core under an enormous pressure, which practically welds the end pieces to the core, forming a very perfect magnetic joint. There are no screws used to secure the core; therefore, no possibility of deterioration of the electromagnetic circuit due to effect of rusty joints and loose screws.

The permanent magnet of the ringer is of the consequent pole type, which has the armature suspended from the central and consequent pole. It strikes a very hard and stiff blow to the gongs, and in perfect unison with the generator pulsations, irrespective of the speed of the generator. This is a very valuable feature when it comes to toll line signaling, where sharp, clear and distinct signals are almost an absolute necessity. The core being situated longitudinally between the end poles of the permanent magnet, is constantly subjected to a magnetic stress, which accounts for the delicate responsiveness of this ringer to extremely weak currents, on the same well known principle under which an ordinary telephone receiver operates, as there is already a magnetic field existing in the core of the ringer, and it is a well known fact, in electro dynamics, that it requires a much smaller current to produce a given effect on an existing field of force, than would be necessary to create the field of force, in addition to the effect. In other words, in operating this ringer, it is not necessary to swing the core, and with it the remainder of the electromagnetic circuit through so long a cycle as is necessary in all previous forms of ringers.

The general appearance of the complete bell, is as in Fig. 4, which shows the long lever gravity switch hook, with Craig sil-

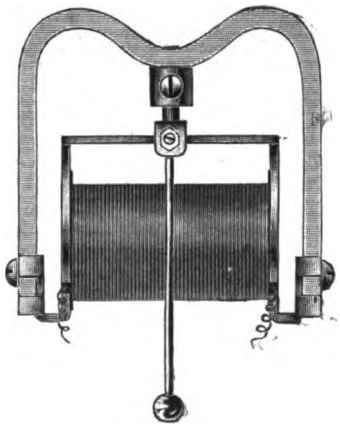


FIG. 3.—THE RINGER.

ver contact pieces firmly attached to a hard rubber block, which, together with the hook, is mounted in the bell box in such a way, as to make the switch hook entirely self-contained, the advantage of which is obvious. The cabinet work is wired throughout with tinned copper wire, which rests between tinned spring washers, secured by screws entering the binding posts, thus forming spring contacts—all other contacts are soldered. This valuable feature will save much trouble due to loose contacts.

The receiver cord binding posts, which are located on the lower left-hand corner of the base of the instrument, are very unique in design, and are formed in such a way as to form a lock for the receiver cord tip, that will hold it like a vise, and at

Digitized by Google

the same time hold it in position with a firm but spring pressure, which will prevent it from working loose and dropping out of the binding post.

In the design of this bell, every point in the construction of magneto bells has been carefully considered, and every defect developed in existing forms, has been studiously avoided and ingeniously remedied. These machines are wound with the best quality of insulated copper wire, to ring through any specified resistance, from the standard of 10,000 ohms up to 150,000 ohms.

This company are also designing a bridging bell system that they will shortly have ready for the market, which, it is claimed, will be clear from all possibility of infringement of the Carty patent, being at the same time fully as efficient.

The works occupy the third and fourth floors of the Kennard Building, No. 80 Seneca street, overlooking Lake Erie. The rooms are well lighted and the floor space aggregates 10,000 square feet. The power is supplied from the building plant, and the tool equipment in the metal working and assembling departments is very complete and of modern design. Among the special machines, may be noted an automatic gear cutter on which the teeth of the gears and pinions are cut, several turret-headed lathes and a number of die-making tools. In the winding department are four specially designed machines for winding the spools and armatures, each of which is provided with an automatic device for registering the number of convolutions. A great number and variety of dies, all of special design, are provided for stamping out the various parts that are made from sheet metal, and these include a large proportion of the material required in the structure of the apparatus, and there are but few parts that require detailed hand work. For the making of the magnets a large power shear is provided on which the bars, which are ⅜ x 1 inch, are cut into 13-inch lengths, and an open hearth double-deck brick furnace for heating the bars preparatory to bending, and this is done on a large bending machine on which either the horseshoe or the double arch magnets are bent to proper shape. These operations are followed by the polishing and buffing processes which prepare the bars for receiving the nickel plate finish, and for which purpose a very complete nickel-plating plant is being installed. One of the most interesting processes in manufacturing the bells is that of magnetizing the bars after they are bent, and for this purpose a constant potential generator is provided, from the current of which a powerful helix is energized with sufficient magnetizing power, it is said, to lift a ton. Across the core of this the bars are drawn several times when they are permanently and strongly magnetized so that the three, constituting a field of each bell generator, are able to lift magnetically 20 pounds. Special care is exercised in selecting the metal designed for the field magnets and it is of such a character that its magnetism has never been known to deteriorate and the nickel-plating does not crack.

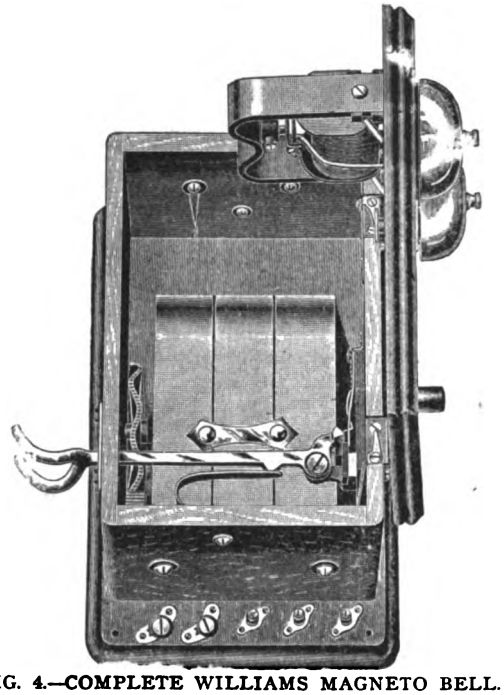


FIG. 4.—COMPLETE WILLIAMS MAGNETO BELL.

The arrangement of the stock room is an illustration of the system that prevails throughout the shop. Here open boxes are provided for each particular part that enters into the construction of the bells or receivers and these are so arranged on stair shelves that any piece at any time may be readily found and the contents of each can be readily inspected and replenished before the stock of any particular box is exhausted. In full running order the works will employ 175 hands and the capacity will be equal to an output of 250 magneto bells per day.

The organization of the company includes the president, J. A. Williams, who was formerly of the Williams, Abbott Company, of Cleveland; the vice-president, Mr. F. J. A. Keller, and B. S. Chamberlin, secretary and treasurer, who was formerly with one of the prominent street railway companies of the city.

W. H. Sills Mica Co.

The W. H. Sills Mica Co., of Michigan avenue, Chicago, have recently put on the market a new line of electrical insulation known as "Micabeston," which has stood the highest tests and is pronounced by authorities "perfect insulation." The line includes Micabeston plates for rings and other moulded insulation which may be made into any form by heating; Micabeston plates for segments for commutator uses, which will not ooze and is so perfectly made that commutators insulated with Micabeston can be put together perfectly without baking, a trifling heat being required to soften the ring so that the commutator may be thoroughly tightened. In addition to flexible Micabeston, oiled cloth and paper, they make all shapes and styles of insulation and have experienced a remarkable trade for the time established. They are now employing 50 people and are adding hands each week. They will open a New York branch before the end of the year, and contemplate sending a representative to England and Germany soon after the new year, with a view to opening a plant to supply European trade.

An Immense Walker Order for France.

An unusually large foreign order for electrical apparatus has been received by the Walker Company, of Cleveland. The order came from the Exploitation des Procedes Electriques Walker, the Paris agency of the Walker Company, and was for 500 complete street railway equipments, comprising 1,000 25-horse-power motors, 1,000 controllers, and 500 trolleys. The apparatus will be the standard make of the Walker Company and will be distributed through cities in Italy, France, and Germany. An officer of the company stated that the order would be equal to equipping all but fifty of the motor cars in use in Cleveland at the present time. The money represented is in the neighborhood of $500,000. The order is to be filled in fifteen months. Apparatus manufactured by the Walker Company is now in use in Alexandria, Egypt, in Paris, and in a number of smaller places in France.

The K. & W. Company's Remarkable Fan Motor Offer.

These are certainly days when no one who has access to the electric current will hesitate about installing in office, household or factory an electric fan motor, especially when it can be procured for an insignificant sum of money. Recognizing this fact, the K. & W. Company, of Pittsfield, Mass., are placing on the market a large number of efficient and handsome alternating current motors which they have bought from a reliable firm who have discontinued the manufacture of fan motors. The balance of the stock which was purchased by the K. & W. Company is being offered by them at prices below cost of manufacture. The motors have been on the market for seven years, and thousands of them have been sold and are running to-day. They are built for 45-58 volt alternating circuits of 16,000 alternations and are sold at the following remarkable prices: $5 for the 9-inch fans, and $7.50 for 14-inch fans.

This offer should appeal strongly to central station managers, who can sell the motors direct to their regular lighting customers. They can either dispose of them at a profit, or at cost, or present them free to some of their best customers or to those whom they desire to secure as customers.

Digitized by Google

Every motor running will increase the day load. They can buy a few of these motors, fit them with cord and attachment plug and leave them at the houses of prospective customers some hot day, and most of them will not permit of their removal. A motor should be set on the sideboard in their dining room and the breeze turned on the table during dinner hour, and they may then fully appreciate what a luxury it is.

The stock of these motors is very limited, and it is simply a case of "First come, first served." The company is prepared to send a motor on trial to responsible parties.

The Beacon Incandescent Lamps.

FOR a number of years it has been the endeavor of lamp manufacturers to construct an incandescent lamp, which, besides giving its rated candle power at the beginning and having a long life will retain this initial candle power for the largest possible number of hours. It appears from numerous tests made by the company and consumers, that the Beacon Lamp Co., of New Brunswick, N. J., have succeeded in producing such a lamp which they have been supplying to the trade in large quantities. The Beacon lamp is claimed to retain its initial candle power for over 300 hours, and anyone who has watched the disastrous effect on the customer's eyes as well as the risk of losing customers on account of inefficient lamps appreciates the value of lamps which have a guarantee of an average maintenance of the initial candle power for so long a time. The company are prepared to send lamps to anyone desirous of making their own tests, free of expense, so that they may judge for themselves how the Beacon lamp compares with other makes. It is claimed that careful photometric and electrical measurements have shown that after 100 to 300 hours the lamp gives more light, uses less current, blackens less and has as long life as any other lamp. The standard efficiency guaranteed by the company is 3.5 watts per candle, but lamps are made from 2.75 watts upward. The company will stand by its guarantee, which they have never failed to fulfil.

Sales of "Gravity" Motor Controllers.

Mr. G. A. Nisbet, general manager of the Electrical Appliance Co., 27 Thames street, New York, reports very satisfactory sales of their new gravity motor controllers. Their device is also finding quite a sale in New England, L. A. Chase & Co., Boston, being the Eastern representatives. In order to fill their increasing trade Mr. Nisbet has just purchased an entire carload of slate which is used in the manufacture of these goods.

American Impulse Wheel Company's Water Wheels.

The American Impulse Wheel Company of New York states that it is making steady headway with its improved water wheel, which is attracting considerable attention in this and foreign countries. The company reports that it has the most satisfactory commendations in every instance, and finds business increasing rapidly. Besides wheels shipped to various parts of the United States and reported giving most favorable results, the company has wheels installed in Japan, France, Sweden and Scotland. For contemplated large power and transmission plants in Utah, Canada, Montana and Minnesota, these wheels are being given serious consideration; and the company confidently expects the adoption in several instances. The Columbus, Ohio, plant, which this company is building will be a novel one, and will be more particularly described in these pages on completion. The company informs us that it has all the advantages embodied in its water wheel of the best heretofore in the market with added improvements as the result of the latest scientific knowledge and test. It claims to spare no pains to perfect mechanical design and construction, together with the highest efficiency, and gives special attention to regulation. Mr. Thorburn Reid is consulting engineer of the company.

LOUISVILLE, KY. A fire in the building occupied by Jas. Clark, Jr., & Co., manufacturers and dealers in electrical supplies on West Main street, resulted in a loss of $20.000. It is said to have been due to the explosion of a barrel of insulating compound.

CATALOGUES.

Wm. J. Murdock & Co.

This company, located at 160 Congress street, Boston, Mass., are circulating a small leaflet explaining their well-known telephone receiver. It is a strictly high-grade instrument of the pony type, has two poles, a hard rubber case, plate binding posts and weighs 12 ounces. The magnets, which are made of the best steel, are supported near the diaphragm, so that the change in temperature does not affect the adjustment. The cost of this instrument is $2. The company will be pleased to answer any further inquiries about this instrument.

Emerson Electric Co.

This company is located at 714-718 St. Charles street, St. Louis, Mo., and has recently acquired control of a large number of alternating current cigar lighters, which they offer, in order to close them out, at $4.75 each. They believe it to be a good operative article, as large numbers of them have been in use for some years. As soon as this lot is disposed of the company will manufacture this appliance and market it under the same guarantee covering all articles now made by them.

Harrison Bros. & Co., Inc.

A very complete and interesting catalogue and price list has recently been issued by the well-known firm, Harrison Bros. & Co., Inc., Philadelphia, Pa. This house, which was founded in 1793 by John Harrison, now has a factory covering an area of thirty-five acres, over two-thirds of which is occupied by sixty buildings of the most improved construction. Seven thousand tons of white lead is produced annually, and their other products include colors for coach, car and house painters, ready-mixed paint, paper makers supplies, chemicals, etc. It might be mentioned that the power plant of this enormous concern has a capacity of over 3,300 h. p., and they own one and one-third miles of private siding connecting with the prominent railroad lines. The catalogue is claimed to be the most complete paint pamphlet ever sent out to the trade, and contains complete information of the following products: White lead, red lead, litharge, zinc whites, "Harrison" oil colors, graining colors, brick paints, artists', decorators', and sign-writers' tube colors, fresco and waters colors, ready-mixed paints, stains, fillers, varnishes, japans, dry colors, acid and chemicals, a complete index and numerous illustrations.

John A. Roebling's Sons Co.'s Souvenir Catalogue.

There is, perhaps, no name which is more closely identified with industrial progress in this country than that of John A. Roebling's Sons Co., of Trenton, N. J., not alone because they are said to be the largest manufacturers of wires for electrical purposes, but also on account of the great miscellaneous enterprises undertaken and successfully completed by this company for a large number of years. It was half a century ago when J. A. Roebling transferred his wire plant and business from Pennsylvania to Trenton, and he was the first to engage in the wire making business in America. The present plant at Trenton covers more than twenty-two acres of ground, on which have been erected thirty-six large buildings. A force of 2,500 operators is employed and the material handled in a year aggregates in the neighborhood of 150,000 tons. Steam engines ranging from 2,000 h. p. down, drive the machinery, and in the boiler house 6,000 h. p. is developed. The electric lighting station supplies current for 200 arc lamps and 2,000 incandescent lamps, through copper conductors which weigh altogether 20,000 pounds. It would take pages to describe the wonderful growth of this remarkable company, and we can do no better in this short notice than to extend to its officers our sincere congratulations on its jubilee. Their souvenir catalogue deserves special mention, as it is certainly a remarkable production, and well worthy of the splendid record held by the company. It

Digitized by Google

contains, first of all, a complete history of the concern, and an elaborate description of all the processes employed by them. Then follow in order the details of construction of various bridges built by them, such as the Niagara Suspension Bridge, the Allegheny Bridge, the Ohio Bridge, the New York and Brooklyn Bridge, and various other suspension bridges. Following this are chapters on logging with wire rope, installations of cableways in various countries and numerous mines, all of them being accompanied by full-page illustrations. Then follow chapters on underground haulage by wire rope, inclined planes, power transmission by wire rope, street railway cables and the Roebling system of fireproof construction, and chapters on wire rope as well as illustrations and price lists of the various kinds of wire manufactured by the company. Then follow in order steel cables, cable and wire terminals and hoisting machines. The remaining portion of the catalogue is devoted to a thorough description of wires and cables for electrical purposes, such as copper and iron wire, magnet wire, lead encased cables, telegraph, telephone and submarine cables, bi-metallic copper wire, silicon-bronze wire for trolley purposes, their well-known Climax resistance wire, the Columbia rail bond, and a large number of valuable and thoroughly revised wire tables. All this represents a great deal of labor and offers by far the best information on the subject of wire rope and electrical wires from the standpoint of the consumer. The book is handsomely bound, is well printed, and has, as a frontispiece, a portrait of John A. Roebling, the founder of this remarkably successful company.

ADVERTISERS' HINTS

THE AMERICAN ENGINE CO., Bound Brook, N. J., say that so perfect is the automatic regulation of their direct connected generating sets, that it simply requires the pressing of a button (opening the throttle) and the machine does the rest.

THE ELECTRIC APPLIANCE CO., 242 Madison street, Chicago, Ill., pride themselves on carrying the largest and best assorted stock of line material in the West.

THE BIBBER-WHITE CO., 49 Federal street, Boston, Mass., call attention to the "Victor" and "New Era" gas lighters.

THE STOREY MOTOR AND TOOL CO., of Philadelphia, are now located at 464 So. Broad street, Trenton, N. J.

J. H. ELLER & CO., 100 East Fifth street, Canton, O., advertise stamped metal ceilings, galvanized cornice, ornamental crestings, galvanized iron skylights and steel roofings, as well as other building materials. They publish a catalogue which may easily be obtained.

THE WESTERN ELECTRIC CO., Chicago and New York, advertise the Lakon transformer and electrical apparatus and supplies.

BEACON LAMP CO., New Brunswick, N. J., guarantee an average maintenance of initial candle power for over 300 hours at standard efficiency on the lamps made by them since the first of the year.

WESTERN NOTES

THE ELECTRIC APPLIANCE CO. have just issued a very neat circular of electrical house goods specialties for which they are general Western agents, giving particular attention to the Noxall annunciator, showing in detail the construction and operation of the machine, etc. The Electric Appliance Company will be pleased to send a copy of this special circular and price list to any of the trade who have not received the same.

CENTRAL ELECTRIC CO. In addition to carrying a large and well assorted stock of the celebrated Loricated conduit for interior wiring, the Central Electric Company, of Chicago, announce that they have full and complete lines of all sizes of circular loom conduit and plain brass and iron armored interior conduit and all fittings.

NILES & SCOTT CO., Laporte, Ind., are ordering another Thomson electric welder. The one they now have cannot keep up with its work, although it welded 112,000 wheels last year.

KOKOMO, IND. The Citizens' Light and Power Co., C. L. Harvey, manager, is in need of a good arc lamp man, who can trim and adjust.

ST. LOUIS, MO., Western Electrical Supply Co. proposes to increase its capital stock from $25,000 to $50,000.

MR. MARTIN J. INSULL has severed his connection with the firm of Sargent & Lundy, and has now opened an office at 1013 Monadnock Block, Chicago, where he will continue as a manufacturers' agent, handling dynamos, motors, incandescent lamps and other appliances.

MR. N. S. PARKER. The Fort Wayne Lamp Co., of Cleveland, O., notify us that N. S. Parker, traveling through the West, representing himself as an agent for the company, is not a representative of theirs at all.

NEW ENGLAND NOTES

FALL RIVER, MASS. The Fall River Bleachery, at Fall River, Mass., have placed the contract for their new mill with the Berlin Iron Bridge Company, of East Berlin, Conn. The building is 65 ft. wide and 200 ft. long with side walls of stone, the supporting framework being made of steel.

CONTENTS.

EDITORIALS:
Municipal Telephony in England 106
The Searchlight and Electricity in the Navy 106
Avoiding Collision at Sea 106
Gold from the Sea 107
Women Car Conductors 107

MISCELLANEOUS:
Means for Detecting the Presence of a Ship or Iceberg (illustr.).. Hermann Herberts. 97
A Capillary Electrometer for Electrical Measurements (illustr.).... Charles Frederick Burgess. 99

POWER TRANSMISSION:
New Transformer Plant at Buffalo for Niagara (illustr.)..... Orrin E. Dunlap. 100
A New German Electric Sewing Machine (illustr.) 101

ELECTRIC TRANSPORTATION:
French Tests of Electric Cabs for City Service (illustr.) 102
General Electric Narrow Gauge Railway Motors (illustr.) 104
Electric Railroading in Eastern Massachusetts 105

ELECTRIC LIGHTING:
Allegheny County Light Co., Pittsburg 108

TELEPHONY AND TELEGRAPHY:
Practical Features of Telephone Work—XVIII. (illustr.)..... A. E. Dobbs. 108
Independent Telephone Combination in Iowa.—Victor Telephone Apparatus (illustr.) 110

LEGAL NOTES:
Important Telephone Patent Decision: The St. Louis Kellogg Switchboard 111

SOCIETY AND CLUB NOTES:
American Electro-Therapeutic Association.—A. A. A. S. and S. P. E. E.—Merchants' Association of New York 112

PERSONAL:
Mr. A. J. Churchward.—Mr. E. M. Smiles.—Mr. A. J. Mathe.—son.—Mr. Carl Modregger, E. E.—Mr. F. W. Peck.—Mr. Theodore Waters.—Mr. J. W. L. Lieb, Jr. 112

LETTERS TO THE EDITOR:
Mr. Tanner on Conventional Electrical Diagrams 112

LITERATURE:
Schoop's "Handbuch der Elektrischen Accumulatoren" 113

NEWS AND NOTES:
To Change the Axis of the Earth and Freeze Out Spain.—Rapid Electric Conduit Laying 113
Flag Raising at the Works of the Fort Wayne Electric Corporation.—Niagara Electrical Engineers in the War.—Sixty-Foot Rails for the B. & O. 114

EDUCATIONAL:
McGill University 114

THE STOCK MARKET:
Peace Prospects 114

TRADE NOTES AND NOVELTIES:
The Franklin Electric Supply House, Philadelphia (illustr.).—Stamped Metal and Cornice Work of J. H. Eller & Co., Canton, Ohio (illustr.) 115
W. H. Sills Mica Co.—An Immense Walker Order for France.—The K. & W. Co.'s Remarkable Fan Motor Offer 118
The Beacon Incandescent Lamp.—Sales of "Gravity" Motor Controllers.—American Impulse Wheel Co.'s Water Wheels.—Wm. J. Murdock & Co.—Emerson Electric Co.—Harrison Bros. & Co., Inc.—John A. Roebling's Sons Co.'s Souvenir Catalogue 119
Advertisers' Hints.—Western Notes.—New England Notes 120

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. AUGUST 11, 1898. No. 536.

Electrolytical Processes for the Extraction, Separation and Refining of Metals—The Tommasi Process.

BY D. TOMMASI.

IN the electrolytic treatment of metallic compounds, more energy than is required for the operation itself has been wasted for the simple reason that in the electrolytic apparatuses ordinarily used, all attempts to diminish the internal resistance and reactions of the bath and to suppress polarization have failed.

The electrical resistance is due:

(1) To the distance the electrodes are kept apart, and this is

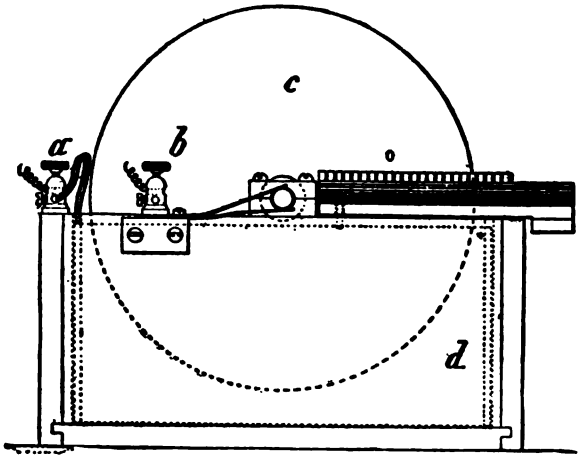


FIG. 1.—GENERAL VIEW OF TOMMASI ELECTROLYSER.

considerable particularly in the case of the refining of certain metals, which instead of becoming deposited compactly, are deposited in a crystalline state, as in the case of zinc, or in a spongy form as in the case of lead, and would lead to short circuitings if the anodes and cathodes were not kept sufficiently far apart.

(2) To the lack of homogeneity of the metallic deposit and its feeble adhesion to the cathode.

(3) To the variation of density of the several layers of liquid, the conductivity of which decreases with the density. These injurious reactions are the result of the attacking action, more or less energetic, of the electrolyte on the metallic deposits, giving rise to the formation of internal counter-currents.

Polarization is caused by the layer of hydrogen gas which is generated at the cathode surface and which sets up a current but in an opposite direction to the principal one.

In order to work as economically as possible,

(1) The resistance of the bath much be reduced to a minimum, and this can be done either:

(a) By avoiding all possibility of formation of short circuits, by which it would therefore enable the electrodes to be brought quite close together.

(b) By taking advantage of the condition of the metal produced.

(c) By making the bath of uniform strength.

(2) Polarization must be done away with by getting rid of the hydrogen as fast as it accumulates on the cathode.

The Tommasi electrolyser (Figs. 1, 2, 3, and 4) consists of a rectangular tank d, in which are placed two anodes p p, between which is placed the anode c, a metallic disc mounted on a gun metal spindle and capable of being rotated.

The disc is not entirely submerged in the bath, but only a part of it is, so that that part comes alternately in contact with the air and the electrolyte.

That part of the disc which emerges from the liquid, when the disc is rotated, passes between two scrapers, O, whose duty it is not only to scrape off the spongy deposit, but also to depolarize the surface of the disc.

The anodes can be either in the form of plates or of coarse powder. When used in a granular state, the compounds are simply packed in a perforated receptacle in the centre of which a metallic plate, to act as conductor, has previously been placed, and to make sure of there being good contact between the granular pieces and the conductors, a similar metallic plate is placed on the bottom of the receptacle on which they lie.

In the larger form of electrolysers, the anodes are made up of two or more parts to permit of their being withdrawn, and replaced if necessary, without having to disturb the disc cathode. The disc is made all in one piece when the metal to be recovered is deposited in a spongy state; it is, however, made in several interchangeable sections when the metal is deposited in a compact state. The sections with which the cathode is built up are fixed to the spindle by means of bolts or screws, which can be unfastened when it is desired to replace any of the sections.

When the sections are coated with a sufficiently thick layer of metal they are withdrawn by a hook at the end of a chain, which is wound round a roller placed over the electrolyser. By a suitable arrangement the sections are taken to a bath of molten metal, similar to that deposited on the sections—into which they are dipped, the electrolytic deposit is melted in the bath and the sections can be taken back to the electrolyser to be again deposited upon.

The advantages of the Tommasi electrolyser over others are as follows:

A. In the case of metals which become deposited in a spongy state, as for example, lead.

1st. Polarization is entirely done away with

(a) By the rotation of the cathode disc in the electrolyte.

(b) By the rubbing action of the scrapers on each side of the disc, such operation helping to get rid of the hydrogen clinging thereto.

2d. The metal deposited on the disc is removed as the deposition proceeds, from which the following advantages are derived:

(a) The metal being continually removed from the oxidizing action of the electrolyte is not liable to be attacked and consequently to forming local couples by which the current set up is in the opposite direction to the principal current.

(b) A considerable diminution of the electric resistance of the electrolytic bath, since it is possible to bring the anodes

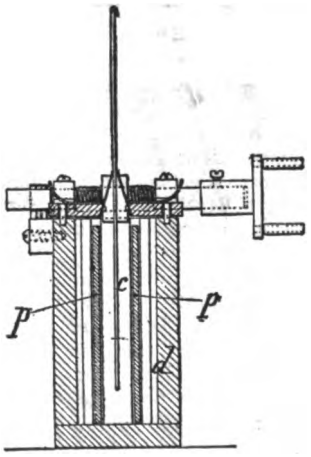


FIG. 2.—VERTICAL SECTION OF TOMMASI ELECTROLYSER.

and cathodes as close together as possible without any short circuits.

(c) Considerable saving in the consumption of electric energy, due to the diminution of the resistance as just stated.

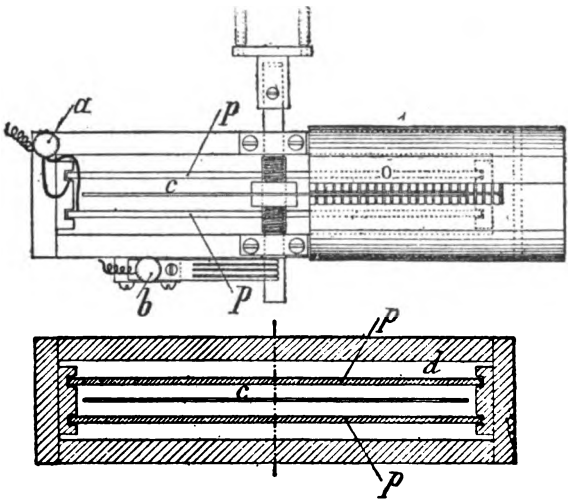
3d. The density of the liquid in all parts of the electrolyser is the same, due to the rotation of the disc which keeps the

Digitized by Google

liquid agitated and mixed without interruption and consequently prevents its becoming saturated at the bottom and feeble in strength at the top, as is the case in ordinary electrolysers where the liquid is at rest.

B. In the case of metals, for example, copper, they become deposited in a compact state.

The density of the layers of liquid which the current passes through, is uniform, owing to the action of the rotating discs, which agitates and mixes the liquid and consequently prevents its becoming saturated at the bottom and becoming weaker



FIGS. 3 AND 4.—PLAN AND HORIZONTAL SECTION OF TOMMASI ELECTROLYSER.

in strength near the surface, as is always the case in electrolysers where the liquid is at rest.

Inasmuch as the Tommasi electrolyser can be advantageously employed in all electrolytical refining of metals, such as copper, lead, zinc, nickel, silver, etc., the recovery of tin from tinned iron scraps, the treatment of matts, the extraction of metals from their ores, more particularly zinc, copper, antimony, gold, etc., we shall only deal with the electrolytic desilverizing of argentiferous lead.

THE ELECTROLYTIC DESILVERISATION OF ARGENTIFEROUS LEAD BY THE TOMMASI PROCESS.

This process can be applied equally to argentiferous copper pyrites, as to argentiferous blendes, and other argentiferous minerals, but we shall only deal with the electrolytic desilverization of argentiferous lead.

The principle upon which this process is based consists in electrolysing a solution of a lead salt, which has not only a very low electrical resistance, but also does not give rise to the formation of peroxide of lead. It is well known that the electrolysis of plumbic solutions nearly always leads to the formation of peroxide of lead, which in being deposited in the anodes forms a couple setting up a current in the opposite direction to the principal current, the effect being to increase the resistance of the bath and consequently also the e. m. f. necessary for its decomposition; and to use the argentiferous alloy itself as anode, the cathode being a disc made of metal, which is unattacked by the electrolyte. Under the action of the current, the lead in the anodes becomes dissolved and deposited as spongy crystals on the cathode disc, whereas all the silver in the alloy being insoluble in the bath falls to the bottom of the electrolyser in a perforated recipient put there for the purpose. In the event of there being antimony and arsenic present with the silver, they can be separated from it by fusing in a crucible with a mixture of borax and sodium nitrate. The antimony and arsenic are converted into antimoniate and arsenate of sodium respectively and all the silver remains in the metallic state.

The electrolyte used is a solution of the acetates of lead and sodium or potassium, to which are added certain compounds, the nature of which is kept secret.

The method of working is as follows:

The argentiferous lead is melted and cast into suitable molds. The ½ anodes—each anode is in two ¼ circular pieces—are attached to four metal rods placed at the top of the electrolyser and which are each of them provided with a screw and bolt. These are in connection with the positive pole of the dynamo. The anodes are so held that not only is it possible to keep the electrodes a fixed distance apart, but it is possible to bring them closer together as the anodes become used up.

The cathode disc is placed between the anodes and is in connection with the negative pole of the dynamo, contact being made by means of a metallic brush rubbing on the spindle of the disc. In working the discs made to make one or two revolutions a minute, the disc whch is three meters in diameter is made of aluminum bronze, or of nickeled iron. It may be made of copper or even of sheet iron. As soon as the current is turned on, the lead commences to be deposited on the disc in the shape of spongy crystals.

When the deposit of lead has been judged to be of sufficient thickness, and it is thought advisable to remove it, the current is switched off and the scrapers are applied. These scrapers are two brass or aluminum bronze plates, which by a simple mechanism can be brought close up against the disc or withdrawn, as the case may be. By the action of the scrapers, the lead is detached and falls into suitable "gutters" by which it is led to a sieve of metallic gauze. The lead is washed with distilled water and submitted to great pressure. The liquid which exudes is collected with the washings, and the whole is evaporated down till it reaches a density of 300 Baume. The solution is allowed to get cold and is pumped into the electrolysers. The compressed lead is heated in a crucible with 2 to 3 per cent. of charcoal powder and cast into ingot molds.

When the anodes are dissolved, they can either be replaced by fresh ones, or the silver which has fallen to the bottom of the tank can be collected. In the latter case, the disc is raised by suitable means, and the perforated recipient, which had been placed at the bottom of the tank at the beginning of the operation, is taken out, as it contains all the silver which has fallen away from the anodes.

Theoretically, the extraction of silver from an argentiferous lead, or as it is most generally called, the refining of lead, by means of the electric current, does not demand any consumption of mechanical energy.

The amount of heat evolved by the solution of a molecule of lead as acetate is exactly the same as that absorbed by the setting free of a molecule of lead from that same salt.

The mechanical energy is, as a matter of fact, utilized solely to overcome the resistance of the bath, which acts as electrolyte and also the polarization of the electrodes. It should, however, be observed that the passage of a metal from the anode to the cathode must necessarily absorb a certain amount of mechanical energy, but this is so very small that it can easily be neglected.

In short, if it were possible to do away with the electrical resistance of the electrolyte and suppress the polarization of the cathode (the anode being soluble does not become polarized) the electrolysis of any salt, using a soluble anode made of the same metal as that of the salt in solution forming the electrolyte, would take place, not without using up no energy at all, but only an excessively small quantity of it and nothing in proportion to that needed in the refining of some metals, and chiefly in the case of lead, with which we are at present dealing.

It has been impossible up to the present to do away with the polarization of the cathode in the electrolytic refining of this metal, and to prevent the formation of peroxide of lead at the anode.

In the refining of lead, the resistance of the electrolyte and the polarization are due to the following:

As regards the resistance:

1st. To the distance the electrodes are kept apart, which must be at least 10 centimeters, for lead, as is well known, becomes deposited in the form of crystals, the volume of which is considerable (more particularly if a strong current is used), and would eventually lead to short circuits if the anodes and cathodes were not kept sufficiently far apart.

2d. Owing to the weakness with which it adheres, the lead deposit would very soon become detached from the cathode and fall to the bottom of the bath, if pains were not taken to frequently collect it, in fact, almost as fast as it is deposited.

3d. To the unequal density of the various layers of liquid the conductivity of which is less as the density diminishes.

With regard to polarization:

To the layer of hydrogen which becomes deposited in the

Digitized by Google

cathode, and which gives rise to a current which is in the opposite direction to the principal current.

In the Tommasi electrolyser, as has already been said, the resistance of the bath is considerably reduced by the possibility of bringing the electrodes closer to each other, even up to two or three centimeters, since the deposited metal being frequently removed, it cannot lead to the formation of short circuits.

As to the polarization, that is completely done away with by the rotation of the disc and the intermittent rubbing of the scrapers, when they are brought into contact with the sides of the disc, in order to take off the lead deposit.

To the important advantages of this process already mentioned, there is one other, none the less important, to be added, viz., the composition of the electrolyte. As a matter of fact, it is not easy to choose a good bath, particularly for the refining of lead, for that bath must satisfy certain conditions, on which depend to a great extent the success of the operation. These conditions are as follows:

1st. The resistance of the bath must be very low.

2d. During the progress of the electrolysis, there must be no crystalline or amorphous deposit on the electrodes.

3d. The lead deposited much be in such a state as to adhere sufficiently so as not to fall off, yet not so strongly as not to be taken off by means of the scrapers.

4th. It should dissolve out the lead only, without attacking the silver contained in the alloy.

These conditions are fulfilled by the use of an electrolyte, the composition of which has been given above, whose electrical resistance is very low, does not crystallize out, nor yields a deposit of peroxide of lead on the anodes, does not dissolve out the silver, and finally yields a deposit of lead which adheres well to the disc and yet is easily detached therefrom by means of the scrapers.

As the result of a large number of experiments, for an electrolyser of the following size and dimensions, the electrical constants, which we will give further on, can be taken as the basis of calculation:

Number of disc cathodes	1
Diameter of disc	1 meter
Thickness of disc	2 m. m.
Height of disc out of the electrolyte	40 c. ms.
Surface of the disc submerged	2,910 sq. c. ms.
Material of which disc is made	copper or sheet iron
Revolutions of disc	1 per minute
Number of anodes	2
Thickness of anodes	1 c. m.
Composition of anodes	argentiferous lead
Distance between the anodes	4 c. ms.
Distance between an anode and a cathode	19 m. m.
Compositon of electrolyte	double acetate of lead and potassium
Current	75 amperes
Resistance of the bath	0.00387 ohm
E. m. f.	0.29 volt

According to Ohm's law, for a given resistance the current varies directly as the e. m. f. on the other hand, if the surface of the electrodes is increased; in other words, if the resistance of the bath is reduced proportionately to the intensity of the current, the e. m. f. will remain the same.

The following are the details of an installation, which would be capable of desilverizing electrolytically by this process, from 25,000 to 30,000 tons of argentiferous lead per annum.

Number of baths in parallel	500
Disc and cathodes per bath	1
Diameter of disc cathodes	3 meters
Thickness of disc cathode	2 c. ms.
Nature of disc	Aluminum bronze
Anodes in each bath	2
Thickness of anodes	5 c. ms.
Nature of anodes	Argentiferous lead
Distance between anodes and disc	2 c. ms.
Revolutions of disc	1 per minute
Compositon of electrolyte	Double acetate of lead and potassium
E. m. f. per bath	0.75 volt
Total e. m. f. for the 500 baths (a)	375 volts
Current	1,800 amperes
Conductor	consists of 400 wires of 6 sq. m. m. cross section
Length of conductor	500 meters
Resistance of conductor	0.0035 ohm
E. m. f. absorbed by conductor (b)	6.3 volts
Total e. m. f. (a & b)	381.3, say, 382 volts
Energy absorbed	687,600 watts
Power of dynamo	721,980 watts
Motive Power	980 h. p.
Cost of a 1000-h. p. engine	200,000 francs
1 dynamo of 721,980 watts, or 5 each of 144,326 watts	80,000 "
500 electrolysers, including the electrolyte at 1,000 francs	500,000 "
Total	780,000 francs
	$156,000
Conductor	20,000 francs
Interest at 10 per cent. on 780,000 francs	78,000 "
Interest at 5 per cent. on 20,000 francs	1,000 "
Coal assuming 800 grammes per h. p. hour at 15 francs a ton	86,400 "
Oil and sundries	10,000 "
2 stokers	5,000 "
2 electricians	5,000 "
30 assistants	30,000 "
	215,400 francs
	$43,080

Lead deposited in the electrolysers.

In each bath, per hour (1,800 × 3.9)	7,020 grammes
In 500 baths, per hour	3,510 kilogrs.
In 500 baths, in 24 hours	84,240 kilogrs.
In 500 baths per annum of 300 days	25,272 tons

The cost of one ton of lead, therefore, comes to

$$\frac{215,400}{25,272} = 8.60 \text{ francs } ($1.72).$$

If work was carried on every day throughout the year it would work out to $\frac{244,923}{30,747} = 8$ francs a ton ($1.60).

Using hydraulic power (waterfall) for driving the machinery, the cost of production of one ton of lead would be

(a) For 300 working days a year,

$$\frac{145,000}{25,272} = 5.80 \text{ francs } ($1.16).$$

the cost of the desilverising of the lead.

(b) For 365 working days a year,

$$\frac{152,794}{30,747} = 5 \text{ francs } ($1).$$

The average cost of the electrolytical desilverizing of argentiferous lead works out at 6.85 francs, say 7 francs ($1.40), a ton. If we assume two francs to include the cost of casting the anodes and of the lead and silver ingots, and incidental expenses at 1 franc, the total cost of the electrolytical treatment of argentiferous lead would certainly not exceed 10 francs ($2) a ton. If, however, we consider that the ordinary process for refining lead costs at least 5 francs ($1) more per ton than pig lead and that, on the other hand, electrolytic lead is much purer than the refined lead of commerce, the conclusion to be come to is that the electrolytic desilverizing of argentiferous lead would not in reality come to, at the most, 5 francs a ton. Notwithstanding these considerations, which nevertheless are not worthless, we shall assume as the basis of our calculations, 10 francs as being the cost of the complete treatment of a ton of argentiferous lead.

By this process argentiferous lead, poor in silver, can be advantageously treated, i. e., containing 150 to 200 grammes of silver to the ton, and even less, if the cost of fuel is not excessive, and, better still, if water power is available. It is just these poor ores which are the most abundant and the purest, and from which it is not possible to extract the precious metal by chemical processes, for the value of the silver would not cover the cost of the desilverizing of the lead. The following table will show better the advantages which this process for the electrolytic treatment of lead poor in silver offers:

Silver present in one ton of lead.

Cost of Tommasi process	10 francs ($2) a ton
Cost of chemical process	30 francs ($6) a ton

Digitized by Google

110 grammes.....profit, 1 fr. (20c); loss, 19 fr. ($3.80)
150 grammes.....profit, 5 fr. ($1); loss, 15 fr. ($3)
200 grammes.....profit, 10 fr. ($2); loss, 10 fr. ($2)
250 grammes.....profit, 15 fr. ($3); loss, 5 fr. ($1)
300 grammes.....profit, 20 fr. ($4); loss, 0 fr. ($0)
350 grammes.....profit, 25 fr. ($5); profit, 5 fr. ($1)

This process cannot only be advantageously applied to the extraction of silver from argentiferous lead, but it can also be applied to many other important purposes, viz., the preparation of spongy lead for electrical accumulators, carbonate and oxides of lead.

Spongy Lead.

The lead recovered from the electrolysers is a spongy mass composed of minute crystals, which are very light and very plastic, and in this state it is an excellent active substance for accumulators of any known system and particularly in the Tommasi accumulator, known as the Fulmen. Its plastic condition renders it easy of application to the electrodes of accumulators, and its fine state of division makes it a substance eminently suitable to be transformed rapidly under the influence of the electric current into peroxide of lead.

The spongy lead used by some manufacturers of accumulators is obtained by the addition of zinc to a solution of lead acetate. The lead thus obtained is not only more expensive than that obtained electrolytically, but it is far from being pure, since it contains the greater portion of the foreign bodies contained in the ordinary zinc of commerce, chiefly arsenic, bismuth and antimony, and the presence of these is detrimental to the good working of the accumulators and causes them to rapidly deteriorate.

As to the cost of production of a ton of spongy lead, it can approximately be taken from the following:

1,832 kilogs of lead acetate @ 650 fr. a ton.....1,190.80 fr.
320 kilogs of zinc @ 450 fr. a ton..... 144 fr.
(This is the theoretical quantity. As a matter of fact, at least 500 kilogs are used.)
Labor .... 20 fr.

1,354.80 fr.

$270.96

The acetate of zinc formed having no industrial application, its commercial value is quite insignificant; in fact, it is practically valueless.

By the Tommasi process a ton of chemically pure spongy lead would cost:

Lead anodes.....250 fr.
Cost of electrolysis..... 8 fr.

258 fr.

That is to say, in round figures, 260 francs.....$51.60

The saving effected would thus be 1,355 — 260 = 1,095 fr. ($219). Assuming an annual consumption of 1,000 tons, the adoption of this process would lead to the saving of 1,095,000 francs ($219,000).

Lead Carbonate. Lead Oxide.

According to the treatment to which the spongy lead obtained from the electrolysis is subjected, it is possible to produce either

(A) Unoxidizable lead, and

(B) Oxidizable lead. { (a) becoming converted into litharge or minium, according to the temperature; (b) becoming converted into carbonate.

(B) Oxidizable Lead.

When the electrolytic lead is acted upon by certain re-agents it becomes easily oxidizable and becomes very hot when in contact with air. The oxidation of the lead is nevertheless only partial, for it does not whiten and remains in a grayish powder. This powder, composed of finely divided lead, does not melt when heated in contact with air, but becomes rapidly converted into oxide of lead. It will therefore be possible to obtain from electrolytic lead, massicot, litharge, and even minium, in a very pure state and very cheaply.

It is estimated that the cost of production of a ton of oxide of lead prepared by this process will not cost more than 20 francs ($4); i. e., its price would come to 270 francs ($54) if lead costs 250 francs ($50) a ton; whereas, litharge and minium prepared by the ordinary processes cost at least 400 francs ($80) a ton, from which it is seen that the Tommasi process leads to a saving of 130 francs ($26).

In order to produce lead carbonate, i. e., lead becoming white when in contact with air, the lead obtained from the electrolysers is submitted to treatment in an apparatus, by the aid of which it is possible to deal with large quantities of the lead. It may be added that this apparatus, being hermetically closed, there is no fear of any carbonate of lead dust floating about in the air, as is the case in the ordinary manufacturing process, and which is so harmful to those employed in its preparation. By this new arrangement this operation is perfectly harmless.

When all the lead has been transformed into lead carbonate it only remains for the product to be washed and dried on slabs of porous ware.

It would be well to estimate the cost of production of lead carbonate by the electrolytic prices and to see the saving effected by it over the ordinary process of manufacture.

The composition of lead carbonate varies according to the process by which it is manufactured. The formula which most nearly corresponds to the ordinary commercial carbonate of lead can be taken as 4 P.C. CO_2, P CO,H_2O. From this formula it follows that for the production of one ton of carbonate the amount of lead theoretically required would be 715 kilogrammes, practically 800.

We have already seen that the cost of production of a ton of electrolytic lead was at the most 10 francs ($2), and consequently a ton of lead carbonate prepared by our process can be approximately estimated to cost:

800 kilogrammes of ordinary lead for making anodes @ 250 fr. a ton.....200 fr.
Cost of electrolysing..... 8 fr.
Cost of making lead carbonate..... 20 fr.

228 fr.

$45.60

Lead carbonate made by the ordinary process costs about 430 francs ($86) a ton, taking the price of lead at 250 francs ($50) a ton. The saving in cost of production by our process would therefore be 430—238=202 francs, say, 200 francs ($40) a ton.

The method just described is not only eminently practical, but also very economical. It must consequently, and in a very short time take a leading place in the electro-metallurgical industry.

The Soot of Acetylene Flame.

The soot of the acetylene flames represents a valuable product, especially for the color industry. When acetylene gas is burned with a smoking flame three or four times as large a quantity of soot is obtained as from the same quantity of mineral oil. The acetylene soot is very light and exhibits an absolutely black color without any tinge of brown. Besides, all tarry admixtures and other substances contained in lamp black, etc., are absent from the soot. It is very bulky and will be specially adapted for India ink, as well as for colors used in printing and lithography. A recent French patent issued to E. Hubon gives three methods for the production of the color. According to the first the acetylene gas is kept in a steel cylinder under two atmospheres pressures and is then ignited through an electric spark or a glowing platinum wire by way of explosion. The final pressure of the resulting hydrogen does not exceed twelve atmospheres, so that the danger of an explosion is excluded if steel cylinders of corresponding strength are employed. This method has the advantage that the theoretic yield of carbon is obtained from the acetylene, the product being of the greatest purity.

NATCHEZ, MISS.—A contract for a term of ten years for electric lighting has been made by the city with A. & M. Moses, who offered 100 arc lights at $103 per annum; city incandescents, 15 cents per k. w.; private arcs, etc., at 18 cents per k. w. The concern gives bond in $15,000, and will at once erect a power house, plant, etc.

ST. LOUIS, MO. The Bell Telephone Co. is introducing slot telephones, on a percentage basis, chiefly in the drug stores.

Digitized by Google

Power Transmission and Distribution for Railway Work.[1]

BY ERNST J. BERG.

WHEN electric power was first applied to railway work, the distances of transmission were comparatively short, so that one generating station usually located in the centre of distribution was sufficient to furnish all power at a reasonable loss.

As the plants were extended it was soon evident that even disregarding the question of efficiency, the distances were very limited for commercial and practical reasons, and boosters connected in series with the line so as to raise the voltage proportional to the load were introduced. By their use it was possible to cover considerable distance and yet keep the potential up without too excessive an amount of copper. Since, however, any booster system must be very inefficient, such installations are not very common, and their field of usefulness limited to cases where considerable power is taken and at the end of a long line for a short time only. The next step toward extension was the introduction of power stations located in various places in the network, but the complication and inefficiency of such an arrangement was apparent, and the possibility of transmitting the power by alternating currents was brought out.

The first suggestion was to generate alternating current power in one station and transmit it at a reasonably high voltage to various sub-stations placed where the steam stations would have been located under former conditions, and there convert it to direct current by means of synchronous motors driving direct current generators. This method of transmitting and converting electrical power was applied in a few cases, but was soon superseded by the converters which not only gave a simpler means of converting alternating current to direct current, but which are more efficient and permit of perfect automatic potential control. Thus in 1894 large and representative converter systems were installed.

Since, with the introduction of long distance transmission the generators were placed far away from the converters and connected to them by lines of considerable resistance and self-induction, it was apparent that potential control could hardly be effected in the power station, at least a control of sufficient sensitiveness to follow the greatly fluctuating loads in a railway circuit, the more so as the voltage does not vary in the same proportion as the load.

It was therefore necessary to develop some means by which the potential could be controlled, not at the generator station, as is done in direct current railway circuits, but in the converter station. This means of regulating the potential was found in changing the phase relation of the current taken by the converter by means of a change of field excitation, raising or lowering the impressed alternating voltage, and consequently the direct current voltage by means of this current passing through lines of considerable self-induction, or through special reactive coils inserted in the circuit.

In the following I shall endeavor to explain this method of control, and discuss its effects on the operation in general.

In a synchronous converter system we have to distinguish between three e. m. f's.; the impressed e. m. f., that is, the e. m. f. at the collector rings of the rotary converter; the counter e. m. f., which is the e. m. f. induced in the rotary converter by the armature revolving in the magnetic field, and consequently proportional to the field excitation; and the e. m. f. of impendance or the e. m. f. consumed by impedance, which is that caused by the current flowing through the reactance and resistance of the system.

The first mentioned e. m. f., that is the impressed e. m. f., is entirely dependent upon the generator voltage; the counter e. m. f. is entirely dependent upon the field excitation of the converter, and is constant regardless of the load on a machine, and the e. m. f. consumed by the impedance changes with the load and is proportional to the current.

To explain the phase relations between these e. m. f's. let us for the sake of simplicity consider the converter running light or doing no work. Since the work done by a synchronous converter rotary is the product of the current taken by the rotary and the projection of the counter e. m. f. on this current at no load the current must be in quadrature, that is, at right angles to the counter e. m. f. Since, furthermore, the input of a rotary converter is expressed by the product of the impressed e. m. f. and the projection of the current on the impressed e. m. f. under the assumption that no energy is consumed, the current is also in quadrature or at right angles to the impressed e. m. f. Consequently the impressed e. m. f. and the counter e. m. f. must be in phase and in opposition to each other. Let, then, the field excitation of the converter be reduced, so that the counter e. m. f. is less than the impressed. Since only three e. m. f's. are acting in the system and their sum must always be zero, that is, the impressed e. m. f. must at any time be equal to the counter e. m. f., plus the e. m. f. consumed by impedance or neglecting the resistance, the e. m. f. consumed by the reactance. The counter e. m. f. is assumed to be less than the impressed, therefore, the e. m. f. consumed by reactance must be in phase with the counter e. m. f. and itself thereto. But since the current is always 90° ahead of the e. m. f. of self-induction it must be behind 90° the impressed e. m. f. and consequently be lagging.

If, on the contrary, the field excitation of the converter is increased so that its counter e. m. f. is higher than the impressed, it is evident that the e. m. f. consumed by reactance must be in phase with the impressed e. m. f. and add itself thereto. Consequently since the current is 90° ahead of the e. m. f. of self-induction it must be also ahead of the impressed e. m. f., in other words, the current is leading. By a similar discussion it is readily seen that the same argument is true, if the converter is loaded. That is, in this case the wattless lagging or leading current due to the difference between counter e. m. f. and impressed e. m. f., merely adds itself in its proper phase relation to the energy current representing the load.

It is thus seen how by means of converter, leading or lagging currents are caused to flow in the lines. It is readily shown how the voltage at the receiving end of the system can be changed by causing a leading or lagging current to flow over a line with some self-induction.

After showing this graphically, Mr. Berg continues by giving an analytical treatment in the course of which he said:

Usually it is required that the converter voltage shall remain constant or increase with the load, when the generator voltage or excitation is kept constant. If each converter is operated from its own generator, it is preferable to leave the generator field excitation constant and thereby use the generator reactance for phase control and avoid any necessity of regulation in the generating station. If, however, many converters are operated from one generator, or if all generators in the power station are operated in multiple, it is preferable to keep the generator terminal voltage constant, and control the converter voltage by outside reactances in a low reactance transmission, or by the line reactance in a highly inductive transmission.

It may perhaps seem as if it would be rather a delicate operation to accomplish this potential control in commercial circuits where available instruments, etc., would prohibit the determination of leading or lagging currents necessary for the control with any degree of accuracy, yet the problem is perfectly simple and resolves itself to adjusting the shunt excitation for a given running light current which is predetermined by calculation, and afterwards to adjust the series field so that the converter takes minimum current, that is, runs non-inductively at the desired load.

It will then follow that the potential control for all intermediate loads is perfect, at least within very close limits, as I shall show later.

The author then showed plainly by means of curves that the smaller the loss the smaller is the running light current and the smaller reactance is necessary. In a system of 5 per cent. loss 30 per cent. reactance, that is such a reactance should be inserted as gives 30 per cent. of rated voltage at full load current. In a system of 15 per cent. loss, however, 50 per cent. reactance would be about as low as we would go, and yet the running light current is 50 per cent. of full load current.

[1] Abstract of a paper read at the 15th General Meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

It is evident also that the more energy loss, the higher should the generator voltage be relative to the converter voltage as shown by the equations.

In the above case we assumed that the converter should run non-inductively at full load; usually, however, it is preferable to run it non-inductively at a somewhat lighter load, say ¾ load.

In this case with 40 per cent. reactance, the running light current is only 20 per cent. of full load current at 10 per cent. energy loss, and with 50 per cent. reactance only 34 per cent. at 15 per cent. energy loss. Therefore it would indeed seem, as if it always were more favorable to run with non-inductive load at ¾ load. This is still more evident, when investigating the power factor curves with these adjustments, yet there are some reasons why sometimes converters are adjusted for non-inductive load at full load as will be seen.

The maximum output of a converter is practically unlimited provided the generator voltage can be increased, and there is sufficient capacity behind the generator.

To obtain the maximum possible output with a given line impedance, the converter should run non-inductively at higher outputs as the generator voltage increases, so that for instance, if the system has 10 per cent. energy loss and 40 per cent. reactance and the generator voltage is kept 12½ per cent. above the converter voltage, the maximum output is 2.12 times rated output and the converter should run non-inductively at ¾ of rated load. If the generator voltage were 18 per cent. higher than the converter voltage, the output would have been 2¼ times the rated, and the converter would run non-inductive at full load and finally, if the generator voltage were 30 per cent. higher than the converter voltage the maximum output would be 2.55 times the normal output, but the non-inductive load would have been 1½ times full load. In other words, the converter should run with lagging current up to 50 per cent. overload.

In commercial installations, however, where there is always a limit to the generator voltage, which limit is caused by saturation of the machine, or outside conditions which do not permit of excessive voltage in the power station, the output of a converter is by no means unlimited, and thus some care has to be taken, to get the proper reactance, since with a given difference in generator and converter potential, the output changes as we change the reactance and resistance.

To show that the output of the converter depends also necessarily upon the resistance of the line, the author presents several curves and continues as follows:

As seen, the output increases very rapidly as the energy loss decreases at least within commercial conditions, that is between 5 and 20 per cent. loss. The maximum output with 40 per cent. reactance and zero resistance would be three times rated output.

With 5 per cent. energy loss the maximum output would be 2.6 times rated output, and the converter should be adjusted for non-inductive load at 1¼ full load.

The condition which is to be met with in a commercial installation is, that the generator is limited to a certain value, that the converter voltage shall be maintained constant at all loads or increase with the load, and that there shall be a certain margin in maximum output and the highest power factors at all loads.

In practice the shunt field is so adjusted that the converter takes the required lagging current running light, and the series field is made to increase the excitation so as to give the required field strength at non-inductive load. Since, however, the series excitation is proportional to the load, it is evident that without hand adjustment, it would be theoretically impossible to accomplish perfect phase control; or rather, it would be impossible to have constant voltage at the rotary converter with constant voltage at the generator. The difference, however, is exceedingly small, the series field being slightly too strong at light loads and too weak at overload, in other words, the voltage will be slightly increased at the converter up to non-inductive load and will drop slightly at overloads.

In the preceding we have not considered this point and have assumed that the theoretical loading or lagging current can be obtained at any load. Consequently the values which we have given of maximum output of the converter are not quite true in practice but the output is always less. The amount of this decrease in output depends upon the magnetic characteristic of the machine and can readily be determined in practice.

Before closing the paper it might be well to discuss the conditions which govern the amount of reactance, etc., in the machines. As stated in the beginning of the paper, in plants where one converter is operated from one generator it is convenient to use the generator reactance for phase-control. Since, however, as seen, it requires considerable self-induction to do this at high power factors, it means a generator of high armature reaction and self-induction, in other words a generator with rather limited output with constant field excitation. This is not objectionable, since by leading or lagging currents the output can really be made as high as desired, even if the armature reaction is high. Yet when considering that it is often desirable to start the rotaries from the generator and therefore its voltage may be reduced greatly at the starting moment when the converter necessarily takes a large lagging current, it may not always be the best policy to use the generator reactance alone for phase control. Often, however, converters are started from the direct current side and sometimes by auxiliary motors. Under these conditions the generator might conveniently be made with very high armature reaction.

In plants where several converters are operated from the generator, or from a number of generators in parallel, control by generator reactance is not to be recommended, since it involves the change of series field adjustments with the change of generator capacity. The generators may be made of any armature reaction since several of them are used in parallel in starting, yet it must of course be borne in mind even then, that if the armature reaction is too high, the large current taken in starting a converter from the alternating current side, may cause the voltage to drop so far as to seriously disturb the system in general.

Regarding converters themselves, it is obvious from the preceding discussion that they must be of composite type, that is, they must have shunt and series excitation.

Shunt wound converters do not permit of automatic phase control, but at constant adjustment of the field will always run at the same wattless current at all loads, so that, for instance, if the field is adjusted for non-inductive load at one load the converter will run non-inductively at all loads, and therefore the drop in voltage at full load will correspond to the energy loss in the system, and the converter voltage will be higher at lighter loads than at heavier loads, therefore will vary as the load varies, and phase control is thus feasible only by hand regulation, that is, in systems where the load varies only slowly as in lighting circuits.

Reaction converters take lagging currents at all loads and thus are in general objectionable, the more so as they do not allow any automatic potential control.

Charging Station for Paris Automobiles.

As a matter of interest to many of our readers, we illustrate herewith the charging station at Levallois, Paris, for electric automobiles, Fig. 1 giving a general view and Fig. 2 showing the light switchboard used in some of the work, with its meters, rheostats, signals and connections. Such a board is portable and can be readily transferred from place to place. It

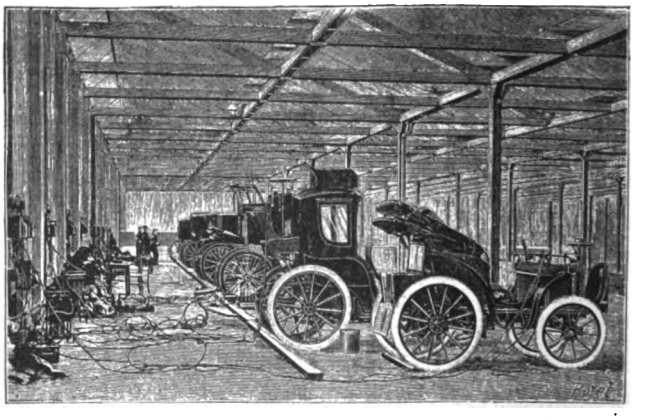


FIG. 1.—AUTOMOBILE CHARGING STATION, PARIS.

Digitized by Google

is worthy of note that in Fig. 1 all the carriages are shown as being charged with the batteries still in them, although the Victoria in the foreground has its battery box open, as if for new cells. In this country, so far as the use of electric automobiles is concerned, while it may be the practice to charge batteries in private vehicles, in situ, those for the public vehicles

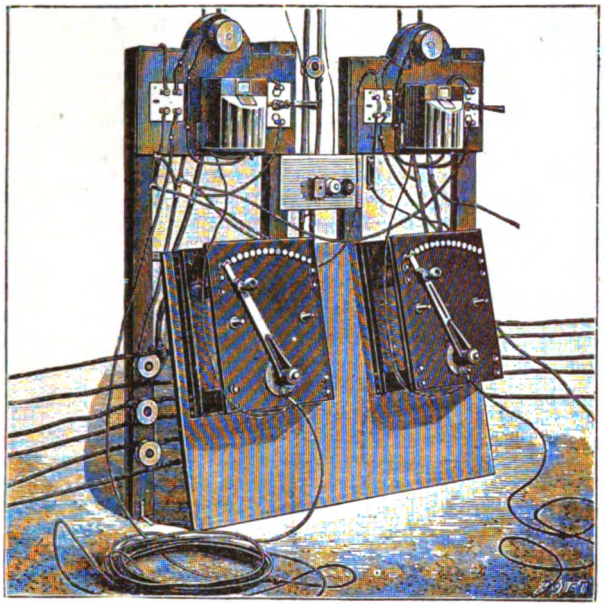


FIG. 2.—AUTOMOBILE CARRIAGE SWITCHBOARD.

are not so charged but are removed when exhausted and newly charged cells are run into the box, so that the same carriage can go out at once into service again in a few minutes. It is obvious that if a carriage has to be charged with its batteries on board, the owner is likely to be deprived of its services for several hours when he may most need it.

TELEPHONY AND TELEGRAPHY

Practical Features of Telephone Work.—XIX.

BY A. E. DOBBS.

SWITCHBOARDS.

RING-OFF drops cannot at present be used by independent exchanges, and they are not really necessary as a non-inductive resistance can easily be shunted around them so that while the drop is still in circuit it will have no perceptible effect on the conversation.

One way in which this can be done is shown in Fig. 53. The line coming into the board is shunted to the jacks P P, thence to the drops D D, after which it is joined to the common return or ground wire G.

As will be seen, the cords are connected together through a non-inductive resistance, R, which shunts the larger part of the current around the drops, but leaving enough to ring off with. For ringing and listening the jacks may be movable or regular ringing and listening keys placed on the table in front of the operator.

Another plan sometimes used is to have switchboard coils of 1,000 ohms each and have them bridged on the line leaving them in circuit for ringing off.

Those who prefer switchboards used by the Bell companies can procure them from the Sterling Electric Co., of Chicago, they having made arrangements with Mr. Frank B. Cook to manufacture his apparatus jointly with the Western Electric Co., and many old Bell men have a strong partiality for the appliances they are familiar with.

In switchboards of this kind (shunted and bridged) there is liable, however, to be considerable cross talk from the close proximity of the coils to each other, which would be absent if they could be cut out, but this can be avoided by the use o. an iron shield which entirely surrounds it, thus screening the inductive effects (Fig. 54). The oldest of these is the tubular shield, the invention of Mr. Frank B. Cook, which entirely surrounds the spool, and is simply a soft iron tube of about No. 16 B. W. G. in thickness. Another form designed to evade this patent and apparently as efficient, is a shield made of half a tube, placed above the magnet spool, and covering fully half of it. Placed in rows, as they are, each drop is shielded from the one either above or below it.

Others have tried wrapping the coil with ordinary tin plate,

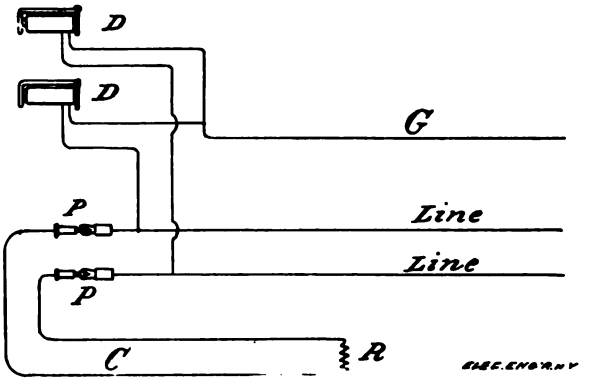


FIG. 53.

but this is hardly enough, unless there are several turns. The back of the board might also be made up in squares like boxes in a post-office, and each drop placed in its own separate box. This little matter does not seem very important, yet as many of the new exchanges are badly troubled with cross-talk, and as most of it can be traced to the switch and cross-connecting boards, it will be seen that it is a little detail worth attending to.

One of the most frequent causes of switchboard trouble are the cords; as the perfect plug for holding the ends of these cords has not yet been invented, the only thing to do is to caution the operators not to pull on the cord in removing plugs, but to always catch the handle.

In some boards, too, the plug rests on a ground plate so that in answering calls, the operator merely has to plug in. If the plate contact, however, is made through a collar at the base of the plug, there is liable to be unsatisfactory service owing to dust and loose connection between this collar and the ground plate.

BATTERIES.

For ordinary telephone work batteries of the sal-ammoniac type are the best, as they are cleaner, less troublesome and last longer than any other.

By sal-ammoniac cells are meant such cells as the carbon cylinder, or Leclanche, in their various forms, in which carbon

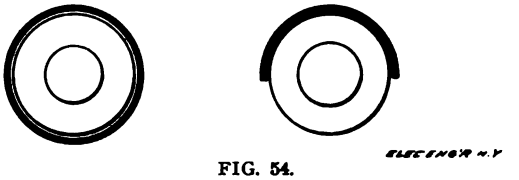


FIG. 54.

combined with manganese, zinc and a sal-ammoniac solution are used.

The oldest, most costly and least efficient of these is the Leclanche porous cup cell, as it has a higher internal resistance, makes more trouble from creeping salts and is shorter lived than any of the carbon cylinder kind.

Most of the independent companies have found this out and have left it in sole posession by the Bell companies, whose reason for continuing its use is something of a mystery. I have never seen this battery used in places where a Samson Laclede battery or a similar type wouldn't do even better.

The main thing in a telephone battery is to get one that will last as long as possible with the least amount of attention. In order to prevent evaporation it should have a closed cover. I

Digitized by Google

have known cells of this kind to last a year without any attention whatever, which cannot be said of any Leclanche cell I have ever seen. In well regulated exchanges, however, some one should make a practice of visiting, inspecting and testing every instrument at least once every six weeks, taking particular note of the batteries.

The internal resistance of batteries is a matter of less consequence than the number of volts they produce, as the current going through the primary circuit is nearly always less than .25 of an ampere.

The best battery for the operator's instrument is the old-fashioned crowfoot gravity cell, because in this case the transmitter is in circuit all the time and they are the only kind that can be relied upon for constant long continued work. On the ordinary granulated transmitter four cells is about the right thing.

With toll line instruments a battery giving a higher electromotive force is desirable, and the standard Fuller cell fulfils the requirements more nearly than any other.

The American Bell company lays down the following rule: "When used in connection with long distance lines, it is recommended that a battery be used which will, at all times, give a current of more than .42 of an ampere at the end of one minute after the battery has been disconnected from the transmitter and connected in circuit with an ammeter and a resistance of five (5) ohms."

It will be noticed that this is the minimum current allowed and as they usually prescribe two of these cells, they can easily get double the amount of current specified.

This cell is set up in a 6 in. x 8 in. jar, and is made up of two solutions. The porous cup in the centre contains a strong solution of salt and water with about a teaspoonful of quicksilver added and also contains the zinc.

In the outer jar, which contains the carbon, is used electropoin or the fluid made according to the following formula:

Solution for Outer Jar.

Sodium bichromate.....170 grams (6 oz.)
Sulphuric acid.....492 grams (17.3 oz.)
Water (soft).....1,600 c.c. (56.5 oz.)

Dissolve first the sodium bichromate in the water, and then add, very gradually, the sulphuric acid. To prevent overheating, the jar should be surrounded with cold water. If the solution is mixed direct in the 6 in. x 8 in. jar, see to it that the jar does not rest on a wet board or metal sink.

The following represents the approximate current, resistance and e. m. f. of the different batteries, which the Globe Carbon Works will guarantee, and other firms will doubtless do the same, if asked:

	E. M. F.	C.	Int. R.
Carbon cylinder pencil, zinc	1.5[1]	1.5	1[1]
Carbon cylinder circular, zinc	1.55	6	.26
Leclanche porous cup	1.5	1	1.5[1]
Crowfoot, gravity	1	5[1]	2
Standard, Fuller	2.2	5	.44
Globe carbon dry cell	1.6	12	.15[1]

As said before, however, the internal resistance does not count so much on the average transmitter as the e. m. f.

For example, take the carbon dry cell, which shows a current of 12 amperes with an internal resistance of only .15 of an ohm on a transmitter having a resistance of 18 ohms, a coil, let us say, of .1 ohm. Using two cells we have then:

Internal resistance ..... .3 ohm
Transmitter circuit ..... 19 ohms
E. m. f. .....3.2 volts
Current, 3.2 ÷ 19.3 = .16 ampere.

Taking the Fuller cell, which has three times the internal resistance and only half the current on short circuit, we have:

Internal resistance 9
Transmitter circuit 19
E. m. f. ..... 4 volts
Current = 4 ÷ 19.9 =..... .2 ampere

Further comment is unnecessary. Nor is this all. In measuring a transmitter circuit with a Wheatstone bridge and galvanometer, we get, when at rest, say, 18 ohms, but talk into the transmitter and the resistance will rise to 30 or 40 ohms, due to the self-induction of the coil so that the amount of current will be only about half that given above, which makes the matter of internal resistance of still less importance.

In setting up sal-ammoniac cells many people use too much sal-ammoniac. Use only a trifle more than the water will dissolve and a longer life and just as much current will be obtained.

[1]Approximate.

Farm Telephony in Michigan.

A special dispatch from Grand Rapids, Mich., of Aug. 1 says: Michigan farmers are taking kindly to the telephone and it is probably but a matter of a few years when the telephone will be as common in the country as it is in the cities now. In Allegan County the farmers have an exchange of their own and they maintain it by annual assessments. The line runs from Holland, through Saugatuck, Ganges, Douglass and Fennville to South Haven, and it is used chiefly during the fruit season to facilitate the handling of berries and peaches. About 130 farmers and fruit growers built the line and maintain it, and the annual assessment upon each is about $10.

Every township in Oceana County has telephone connections with Hart, the county seat, and this system is essentially a farmers' exchange, and is owned and maintained chiefly by the farmers and fruit growers. The Oceana County system, as also the Allegan County fruit growers' line, is being connected with a State exchange, and before the peach season fairly opens the farmers in both sections will be in easy talking range of the commission and railroad men here and the steamboat men at the lake ports.

Gratiot County has another farmers' exchange which, with Ithaca as the centre, has connections with every township and many farmers. The system gives free service throughout the county to its subscribers and will soon be connected with the outer world. It is a great advantage to the farmers in marketing their products.

Farmers living near the cities are having the telephone wires extended out to them, though the movement is still in its infancy. The Citizens' Exchange in this city has about a dozen farmers on its list, and that it has not a hundred or more is due to the rush of construction work in the city since the exchange was established. The first country telephone was to a farmer about a mile west of town. With direct connection with town he could sell his stuff in advance, arrange for his deliveries, and easily keep his finger on market conditions. It gave him a big bulge upon the other farmers, and it did not take his neighbors long to find it out. The line now runs out about five miles and all the substantial farmers along the line have hitched on. The farmers north and northeast of the city are clamoring for connection, and in another year they will probably be accommodated. The lettuce growers just south of the city all have connections, but they are so close to the city they are hardly called farmers.

Independent Telephony in Maryland.

The officers and Board of Directors of the Interstate Telephone and Telegraph Company held a meeting at Frederick, Md., on July 26. Mr. L. A. Carr, of Durham, N. C., the president of the company, was present, as well as the following officers: Vice-president, Dr. P. D. Fahrney; secretary and treasurer, J. S. Carr; local superintendent, John J. Murray; Board of Directors, Messrs. Dr. P. D. Fahrney, G. W. Watts, Jas. E. Walker. The business of the company is in a most satisfactory condition. Besides the 300 telephones in the city, the following county towns are on the circuit; Adamstown, Buckeystown, Buckeystown station, Ceresville, Ellerton, Feagaville, Frederick Junction, Harmony Grove, Ijamsville, Pearl, Jefferson, Le Gore Station, Lime Kiln, Middletown, Mt. Pleasant, Monrovia, Myersville, New Market, New Midway, Routhland, Urbana, Walkersville, Woodboro and New London. In a little while the towns of Braddock, Liberty and Ladiesburg will be connected.

Payment of Telegraph Tax.

The Western Union Telegraph Company has secured a restraining order against the North Carolina Railway Commission's order of 1897, reducing the rate on ten-word messages from point to point in the State from 25 cents to 15 cents, and also against the order of July 13, reducing the rate from 25 to 24 cents, in order to make allowance for the one-cent war tax stamp.

Digitized by Google

CINCINNATI, O. The City and Suburban Telephone Association has sent to the Army and Navy League its check for $500, Col. G. N. Stone, general manager, writing that it "desires to express its admiration for the bravery displayed, and appreciation of the services rendered by our gallant soldiers and sailors at the front." The fund is for wives and children needing temporary assistance.

DETROIT, MICH. The Detroit Switchboard and Telephone Company has increased its capital stock from $100,000 to $250,000. The company's apparatus is to be supplied to a large new telephone exchange for which plans have been made and the capital raised in New Orleans. It is to have a board with 5,000 drops.

INDIANAPOLIS, IND. The New Telephone Company has awarded the contract for 265,000 feet of conduit pipe for its underground system to the H. B. Camp Company, of Aultman, O., and will prosecute briskly the work of laying it, having now, it is said, 3,000 subscribers assured.

SCRANTON, PA. The Lackawanna Telephone Co. has made an appeal to the citizens for a liberal franchise, promising to put up an exchange second to none in the country and to cut rates in two.

TERRE HAUTE, IND. The Citizens' Telephone Co. has given a contract for poles to the Kerby-Dennis Co. of Marinette, Wis., the poles to be No. 1 live peeled white cedar.

DETROIT TELEPHONE CO. is being sued by the Western Electric Co. for alleged infringement of switchboard patents, asking an injunction.

LIGHTING BY ACETYLENE. By Wm. E. Gibbs, M. E. New York: D. Van Nostrand Co., 1898, 5x8. 141 pages, cloth. Price, $1.50.

Of late the manufacture of calcium carbide and the rapid introduction of acetylene for lighting purposes has brought the question of the production of these two agents, as well as the apparatus for the use of the latter prominently before the public. And while the art of lighting by acetylene seems far from being on a permanent, or even satisfactory basis, it seems to have been sufficiently advanced to have its progress up to the present date collected and, after careful sifting of the material on hand, to publish it in book form. The author has certainly presented the matter in a most interesting and instructive manner, and the little volume contains much matter of general interest on the following subjects: History of acetylene, electric furnaces, generation of acetylene, the impurities of carbide and purification of acetylene, generators of various types, acetylene lamps, and burners, the author's own experience, concluding remarks on the state of the art in this country, fire regulations for the installation of acetylene gas generators and a complete list of United States patents bearing on the subject.

THE TELEPHONE. By W. J. Hopkins. New York: Longmans, Green & Co., 1898. IX—83 pp., 5 x 7¼ in., 49 illustr. Cloth. Price, $1.

This little book by the author of "Telephone Lines and Their Properties" has the commendable qualities of the earlier publication. In the preface the author states that he has "avoided making a descriptive catalogue of instruments and has endeavored to set forth the facts and principles in such a way that they will be easily and clearly understood." An introductory chapter on sound gives the knowledge requisite to an understanding of the book. In a short chapter the early history of the Reis and Bell telephones are considered. Then follows a scientific description of the development and working of transmitters. The systematic investigations on the working of the receiver and transmitter which have been carried on for the last ten years at the Massachusetts Institute of Technology are given due notice and their part in the development of the transmitter shown.

The book is excellently illustrated, the language clear and concise, and the statements are correct. This little book should be in the hands of all who desirde to understand the telephone transmitter and receiver. A.

MR. EDWARD WESSELS (formerly managing director of the Standard Air Brake Co.), who is the owner of the illustrated weekly newspaper, the "Universe," has just purchased all right, title and interest in "Sunbeams" Magazine. "Sunbeams" has been in existence seven years, and enjoys excellent advertising patronage, as well as a large subscription list. Mr. Wessels will merge "Sunbeams" into the "Universe"; the publication offices will be at 150 Fifth avenue, New York City. The "Universe" has rapidly worked its way into favor, and now goes to all parts of the world.

"FACTS ABOUT THE SOUTH" is the title of a valuable and interesting pamphlet on the advance of the South, and detailing the possibilities there, by R. H. Edmonds, editor of "The Manufacturers' Record," Baltimore. It contains thirty pages crowded with useful and suggestive data. The price is 20 cents.

MR. HIRAM S. MAXIM arrived in this country on Saturday from Europe, for a stay of three or four months.

MR. G. A. LORING is the new superintendent of the San Francisco and San Mateo Electric Railroad, vice Mr. S. B. McLenegan, who has resigned. Mr. W. Clayton, secretary, will be the chief executive officer of the road.

MR. ERNEST GONZENBACH, electrical engineer, who has been associated with power transmission work in this country, has become superintendent of the Chambly power plant at Montreal, Canada.

MR. G. W. MANSFIELD, of Melrose Highlands, Mass., was in New York City recently. He reports that he is still actively engaged in electric railway work and says he will be glad to hear of any such enterprise that needs pushing or reorganization.

MR. JOHN A. BRILL, whose name appeared as that of a director in the new General Electric Automobile Company, of Philadelphia, finds that owing to the great rush in the car building business of the J. G. Brill Company he is unable to serve in that capacity.

MR. W. D. SARGENT, president of the International Brake Shoe Company, left recently for Europe to make arrangements for the manufacture of the Diamond "S" shoe in several European countries, including Russia. The success of this shoe since its introduction last fall is said to have been little short of phenomenal.

MR. ALFRED J. THOMPSON, a young engineer, who has been personally identified with Mr. Edison since his graduation from an English college in 1889, is about to leave the United States for a long and indefinite period. During his years of intimate association with the "Old Man" he made frequent visits to Cuba, where, through influential relatives, he installed several electric light plants and supervised other electrical interests. He has acquired such a thorough knowledge of the Spanish language as to prove a capable representative for the many American interests now being entrusted to his care. Mr. Thompson will have his headquarters in Havana, from where he will direct the operating plants under his control and extend "feeders" for the extensive business which he and his hustlers intend to build up. When Mr. Thompson was seen a few days ago he had completed his arrangements with nearly every firm whose products will be necessary for his electric light, telephone and traction work, and for those who would be represented in that hereafter prosperous island they would do well to have such a well endorsed and able man to push their goods and have their products in on the ground floor of the industries which are sure to concentrate there under the Stars and Stripes, and to be in there before the "surely coming" avalanche of American capital and energy arrives there.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1888.*]

Vol. XXVI. NEW YORK, AUGUST 11, 1898. No. 536.

The Detroit Municipal Convention.

NOTE is made in our pages this week of the meeting at Detroit of the League of American Municipalities. It appears to have been a serious and well designed effort, but one may doubt whether it was much of a success. Very little work apparently could be got out of the delegates, but all the entertainments drew big crowds. Even the entertainment feature, however, had a disagreeable aspect given to it. The city council had voted $5,000 for junket, but a number of the citizens intervened, and secured first a preliminary and then a permanent injunction restraining the city and the Board of Education from expending these funds. Such a step had in fact been anticipated up in Massachusetts where a town appropriated money to send its mayor and aldermen to the meeting, but were prevented by an injunction. So what with would-be guests held back by law and would-be hosts also forbidden by law from entertaining, the League meeting at Detroit cannot be said to have been an altogether happy performance.

After all, the entertainment part should matter little, and Secretary Gilkison was right when he said they did not want it because it distracted the delegates from their work. Many a convention has been spoiled in this way. But the fundamental reason why the papers read were so poor and why the audiences to hear them were so meagre lay in the very make-up of the League. We cannot do better than quote one of its own members: "There is no profit in it for the delegates who come to the conventions. The stove manufacturers of the country, for instance, will hold a convention and the business meetings will be attended by every single delegate. Every word of every speaker will be eagerly listened to and the men will go home with new ideas and large amounts of information that will enable them to produce stoves more cheaply and therefore increase their own profits.

"With these fellows, it is entirely different. They hold their offices by the votes of the people. At best their time in the positions is limited. What do they really care about sanitary measures or street paving or garbage disposal? It's no money in their pockets. The interest of men in things that are not entertaining or amusing in themselves is measured by the amount of money there is in it. No money, no interest. That's all there is to it. Gilkison is the only man I have seen from outside of Detroit who is deeply interested in the convention. The Detroit people are interested in the entertainment end.

"The fact is the success of the association largely depends on use of public money for sending delegates to the convention. A council in a Massachusetts town appropriated money to send the mayor and aldermen here. An injunction was obtained from the courts, and the delegates didn't come."

There is a lot of hard, solid truth in this. The stove manufacturers, like the electric light men, or the civil engineers, are in their business to stay. Each convention adds to their stock of knowledge or to their list of professional acquaintances and friends. But it is obvious that the personnel of the municipal league must vary tremendously from year to year, depending on the political fortunes of its constituent members, and we all know that a mayor who succeeds himself in the United States is a rare bird; while for an alderman to remain long in office is equally unusual. When we come to the rank and file of city officials in charge of specific departments, they also have but too often a precarious position, and as we understand it are not exactly the kind of men who attend the League meetings. Such men go off by themselves like the municipal telegraph superintendents meeting this week at Elmira, or like those attending fire brigade conventions. It would certainly seem far more natural that city officials wanting to keep in touch with the work they represent would attend the meetings of societies devoted to that work and not conventions discussing casually all manner topics from the saloon and the social evil to toll bridges and municipal choral societies.

Another thing is that necessarily all who go to such a convention as that of the League, go to report "successes" or to help personal booms of one kind and another. Now a convention is an experience meeting, and the discussions bring out the things and methods that failed. But no mayor and no official is going to come away from home and report the failure of some pet scheme; nor is any insistence likely to be laid on disaster. Prof. Bemis, for example, enlarged on municipal ownership of lighting plants. Did he give the data of plants that had broken down, failed, been sold, had gone out of existence, or do not come up to fond anticipations? On the contrary, it was the bright and pretty side of the picture that was presented.

Those of us who live in New York, and who have steadily on hand a hard fight for purity in municipal affairs, may be forgiven if we view askance any movement to add to the responsibilities and evil opportunities of city officials; and also if we doubt a little as to the real good that can come from meetings of the League, such as that at Detroit, well intentioned as many of its members are, beyond question. But even in Detroit, while the glamor of the occasion is over the scene we trace the same lurking scepticism, as expressed and summed up by the Detroit "Tribune" in the follwing paragraph: "The 'Tribune' trusts the League will not overlook a solution for that most important municipal problem, 'What shall we do with the workers between elections?'"

German Central Station Statistics.

JUDGING from the reliable data collected and published by the "Elektrotechnische Zeitschrift" the condition of the electrical industry in Germany continues most gratifying and encouraging. The figures given by our contemporary only relate to central stations supplying current for light and power to entire cities, towns or large sections of them, excluding private installations and those supplying electric railroads. The statistics bring the state of the industry up to the first of March, 1898, and show that over 100 new stations have begun operation during the past year, the number of stations increasing from 265 to 375, besides 78 stations are in course of construction, and the prospects for the coming year are indicative of a large increase. The continuous current still holds its own in first place, being distributed by 81 per cent. of all stations, while their output is only 59 per cent. of the entire station output. Their number has increased 48.5 per cent. over 1897; 89 per cent. of these stations have battery accessories whose output amounts to about 31 per cent. of the total; 29 stations employ the alternating (single phase) current, an increase of only 11.5 per cent. over 1897. There is, however, a 42.5 per cent. increase of polyphase (Drehstrom) stations and their total number now amounts to 23. Their output has increased 84.7 per cent. over 1897; 18 stations generate both polyphase and continuous currents, and their output has increased 164.4 per cent. over the previous year. Single phase alternating and continuous currents are generated in 5 stations, an increase of 66.7 over 1897, while their output has been increased 6.88 per cent.

Germany, possessing but little available water power, has to depend almost entirely on steam as a motive power for central stations, and the statistics therefore show that of all the stations 84 per cent. are operated by steam, 14 per cent. by water and 2 per cent. by water and steam combined. However, it should be

Digitized by Google

noted that only very small plants, generating less than 100 k. w. use water for their motive power, only 8 stations having an output larger than that. About 4 per cent. of all stations use gas as a motive power, and several use both gas and water.

Another table gives a comparison of the works according to their output, and it is shown that 61.6 per cent., or over half of all stations, have an output of less than 100 k. w., about 27 per cent. between 101 and 500 k. w., 20 stations between 501 and 1,000, 14 from 1,001 to 2,000, 8 from 2,001 to 5,000, and 3 a total output of more than 5,000 k. w. Nearly all stations have been materially increased during the past year.

Another feature of great interest brought out is the increase of the stationary motor load, namely 64.4 per cent. over 1897. The incandescent lamp load increased 39.3 per cent. and the arc lamps 30.2 per cent.

The total output of the stations is equal to 2,401,067 lamp equivalents equal to a capacity of 111,539 k. w. The motor load is 28.9 per cent. of the total load of the stations which is a remarkably high figure.

Another table shows the rapid increase of the electricity supply works during the past ten years, the number having increased from 59 built in 1896 to 90 built in 1897. To show that there need be no fear of a sudden halt in this rapid increase, it is pointed out that there are a large number of important and well-populated cities without a central station, and that these will soon demand it for their every-day comforts and conveniences. Another table is added to show the distribution of the electric light in several large German cities, giving the number of lamps per 1,000 people in cities with over 100,000 inhabitants. Berlin, for example, with a population of 1,677,304, has 217,612 incandescents, 130 for each 1,000 inhabitants, and 298,392 arcs, or a total of 178 incandescent lamp equivalents for each 1,000 inhabitants, while for Bremen with a population of 141,894 this figure reaches a maximum in 338, and in Dortmund, with a population of 111,232, it is a minimum in 57. From these figures it will be seen that there exists a most wholesome condition in the German central station field and one which cannot but have a most beneficial effect on the entire electrical industry in that country.

Recent Progress in Electrolytic Operations.

ON other pages we give a detailed description of the Tommasi electrolyser, a simple and apparently efficient apparatus for the extraction, separation and refining of metals. In view of the rapid strides made within recent years in electrometallurgical operations and the saving effected thereby, the process described by Mr. Tommasi is full of promise, as the inventor has carefully studied the difficulties inherent in the present methods and the necessary conditions to be fulfilled for the most economical working, and has constructed his apparatus accordingly. It is universal in its application for the electrolytic refining of metals, and the advantages claimed for it are (1) the doing away with polarization, (2) the removal of the metal as soon as it is deposited, (3) equal density of the liquid in all parts of the electrolyser, due to the fact that it is continuously in motion. Mr. Tommasi also shows the application of the apparatus to the electrolytic desilverization of argentiferous lead, pointing out its several essential advantages over existing methods, and he gives the results of a series of experiments made to determine the dimensions of a plant for working his process. His figures show a decided gain from using the Tommasi apparatus, the profit being even more apparent from his figures in regard to a plant for the production of spongy lead used for accumulator purposes. It appears from these calculations as if Mr. Tommasi has materially advanced the state of the art, especially in the economical extraction and refining of the heavier metals.

More progress, however, has been made in recent years in the electrolytic production of the lighter metals, principally among which are magnesium and aluminum. Metallic sodium has also recently been obtained by electrical means. Another problem of great interest is the electrolysis of alkali-chlorides in water solution, such as the chlorides of sodium and potassium. While considerable progress has been made in this direction, a number of difficulties have presented themselves which are being slowly overcome by improved appliances and methods. Among these may be mentioned the secondary reactions taking place, the formation of the caustic alkali and its reduction and the inability of the carbon electrodes to withstand the action of the chlorine for a considerable time.

The production of iodoform by electrolysis, which has also been accomplished of late, has become a most promising industry, and shows the possibilities of the electric current in the domain of organic chemistry.

Protecting Well-Behaved Lighting Corporations.

A RECENT decision by a committee of the British House of Commons is being regarded with considerable pleasure by our friends in England and is worthy of note from its bearing on questions here. The particular instance was that of Marylebone, a large and rich section of London, where the Metropolitan Co. has been at work for some ten years past, under a "provisional order," as it is called, which required the lapse of forty-two years before the vestry could purchase the plant. But the company, having worked up its business in good shape, the vestry thought it would be nice to take a hand itself, and thereupon applied for "concurrent powers," just as some private companies have done in places where municipalities have plants. When the question came before the House of Commons the Association of Municipal Corporations supported the vestry, and it was referred favorably to the committee, where the real tug came, evidence being taken for and against. On one side it was urged that local authorities should be able to do electric lighting even with a company already working in the district. On the other side, the doctrine of "peaceable possession the reward of good behavior" was urged, aside from contract rights, together with the argument that any such disturbance of the security of tenure would scare capital and retard the industry. As we have noted, the committee has protected the company, at the same time protecting against any company a local authority that has already by original order or purchase engaged in the business.

This decision, it seems almost needless to add, has given general satisfaction, and one result has been a healthy rise in electrical securities. Many lighting companies here that have been violently assaulted and had their property undergo virtual confiscation might well wish for a similar treatment. The English ideal of equity and justice shines through the transaction just as it does in the work done by the Massachusetts Lighting Commission, endowed by the State with powers which enable it thus to arbitrate in such matters.

"Electric Belts."

THE exact incidence of some of the new war revenue taxes is still uncertain. We have made note of the struggle over the one-cent tax on all telegrams and the success thus far of the telegraph companies in leaving it for the customer to pay. But there are some unexpected points in regard to other items, and we are very sorry to note one decision falling within the proprietary schedules of the law, and that is, that "electric belts" are held to be mechanical appliances and not taxable under Schedule B as medicinal preparations. Electricians will hardly find fault with the dictum that an electric belt is not a "medicinal preparation," but they will be at a loss to understand why it passes muster as a "mechanical appliance." It does not hold up the trousers of its wearer, neither does it pull down his shirt or vest. It is true that it is not held on magnetically, but that is also true of collars and socks, and they are not looked upon as in any sense mechanical appliances. If an "electric belt" were held capable of hitching a steam engine to a dynamo and thus helping to generate current the propriety of the term would commend itself, but we have never seen an "electric belt" used in that way. Perhaps our readers have, and will be better able than ourselves to penetrate the mental mysteries of the fiscal expert who looks on electric belts in the light of suspenders. We accept the dictum that "the first absolute pre-requisite to the imposition of the tax is that the article should be medicinal in its character," for that is certainly what the "electric belt" is not. But why should mechanical be the alternative or antithesis to medicinal? Why not say outright that the belts are fakes?

THE Volunteer Engineer Corps went on board the fine transport Chester for Porto Rico on Saturday last, mustering nearly 1,100 strong. The ship was visited by many persons while lying down the bay.

Digitized by Google

Detroit Convention of the League of American Municipalities.

THE League of American Municipalities held its second convention last week at Detroit, Mich., and had a large attendance of delegates and visitors, numbering probably 1,000. The League was heartily welcomed by Governor Pingree and Mayor Maybury. In his opening address President John MacVicar, of Des Moines, Ia., said:

"It is the work of the League, so far as it embodies and represents the public determination to have good city government in this country, to study the question before it in a broad way. American cities must be made wholesome in every sense of the word. They must, if such a thing be possible, be made to conserve and not consume the energies they draw from the country. They must have no slums to pollute the currents of their own lives and the life of the nation. The garbage question, the tenement question, the water question, the franchise question, the question of parks, public baths, playgrounds and other means and instruments of public health and recreation, must be studied in their larger relation to the preservation of the life and health of our great republic.

"We are at an early stage of the movement; the country has but recently awakened to the need of it. Some of the matters to which I have alluded are for future generations to adjust. At the threshold of the agitation we are most concerned with the vital issue of the sovereignty of cities. It seems necessary as a preliminary measure to eliminate from our cities the private ownership of franchises for the monopolized use of the streets. The public must own and operate all plants for the supplying of light and water. Probably it should extend its powers so as to take in street railways, heating plants, telephones and other means of intramural communication. At all events, there must be an end to the controlling and corrupting of our city governments by those interested in the manipulation of public comfort, even if the last vestige of private ownership in them shall be uprooted.

"To those good but misguided people who, without having perhaps devoted time to an examination of the subject and are therefore disposed to oppose municipal ownership and control of the natural utilities represented by water, gas, street railway and electric lighting plants, I would put this pertinent question: Whence the fertile source of those corrupting influences which too often debauch city councils and as often lead State legislatures, and perhaps sometimes our national Congress, astray? Did they ever hear of a city or State tempting a public official with bribery to betray the interests he has sworn to protect? Surely not. The potent cause to which public officials sometimes yield must be sought for elsewhere. Are not the colossal opportunities offered through the medium of exclusive privileges granted by city councils and legislatures the very foundation of this evil? I think you will agree with me that they are. Therefore, if these valuable franchises, these splendid privileges, were reserved to the cities, would not this source of corruption which has caused legislative bodies to become a byword among the people cease to exist?

"Such a change involves the necessity of civil service reform. I am aware that our western metropolis at a recent political convention declared for municipal ownership of public utilities and for the repeal of the civil service laws. To my mind it would be suicidal to enlarge the function of municipalities without providing for the thorough application of the merit system in appointments, promotions and removals. We who believe in municipal reform are in the paradoxical position of proclaiming that our cities are doing badly that which they are doing, yet urging that they assume new duties. But the logic of our contention is better than it seems. Burden develops responsibility. There is a reserve of patriotism and capacity of self government in our citizenship to which we are not afraid to appeal. Nothing could do more to bring out the latent virtue of the indifferent citizen than freighting the ship of state, already, as he fears, overloaded, with still dearer interests. I am not afraid to startle our money-making voters by producing a situation which will alarm them into a state of perpetual political vigilance. They need to be alarmed. Arouse them to the seriousness of the prevailing condition and the spasmodic energy which now cleans the Augean stables of municipal corruption once in ten or fifteen years will be harnessed by unavoidable necessity for regular activity. Public sentiment would from sheer necessity and constant contact with these public servants, whose functions would be to supply them with street transportation, light and water, exert an influence that would not be satisfied excepting with the best service possible. Every citizen would be interested in securing the greatest efficiency in the public service, and in a very short time demands would be made by a quickened and enlightened popular sentiment for the enactment of a strict civil service law. So long as the corporate interests operate these public utilities for private gain just so long will we have uncompromising opposition to civil service and good city government. Remove first the incentive to this opposition, which to my mind can be accomplished by removing our public franchises from the public mart, and a new era will dawn in which the best citizenship will be the dominant force in municipal government.

"These two reforms (municipal ownership and civil service) accomplished, there will be less to prevent the peaceful evolution of good government in municipalities. I place them first because they are logically first, and will open the way to others. But as I appealed a few moments ago against the too concrete treatment of these questions, I must warn you against being too theoretical and uncompromising in handling them. We should not insist that progress and improvement come to us in a certain order. Let us rather rejoice that the leaven of municipal reform is everywhere at work, rousing the public to a new sense of obligation of citizenship. If better city government does not come in the order we deem logical and proper, we should welcome it in all its aspects and contribute in every possible way to the advancement of the cause."

Secretary B. F. Gilkison reported the present membership of the League at 71 cities. He alleged that corporations had waged war against the League, with possibly injurious effect.

A number of topics were discussed during the convention, including the operation of municipal lighting plants, upon which Prof. Bemis spoke, without giving any new data.

On Friday, the morning session was devoted to an active discussion of the "Municipal Ownership of Public Industries."

T. S. Murray, mayor of Denver, spoke on "Remuneration to cities for franchises rights in, over and under public streets and alleys. What remuneration, if any, should be exacted from light, water, street railway, telephone and subway corporations, and how should it be collected?"

He declared the proper management of the government of municipalities to be one of the serious questions of the day. The population of the large cities is annually increasing much more rapidly than that of the agricultural communities, the tendency of population being to concentrate in the cities. In 1790 only 3 per cent. of the people of the United States resided in cities, but in 1890 this had increased to nearly 28 per cent., while it is now estimated at one-third the entire population. This rapid increase of urban population is constantly raising new questions of municipal government that are of the first importance to every resident and property holder of a city, for he comes in contact with the city government a hundred times to the State or national government once.

A constantly increasing tax rate is not received with favor by the taxpayer, but at the same time the average citizen clamors for improvement in every department of the public service. Attention is then given to the possibilities of increasing the revenues of a city without placing unbearable burdens upon real estate and improvements, and the conclusion of such contemplation is that profligacy has ruled in the bestowal of valuable franchises.

Then it is that the citizen learns that the franchises so freely given by willing councils and mayors to great corporations, covering the great public utilities of the municipality, have been turned in as a valuable item of property among the assets of the corporations and a large amount of money borrowed thereon. The conclusion is inevitable that if a franchise becomes a thing of value as soon as it is received by a corporation, it is of value when asked for at the hands of the representatives of the people.

Digitized by Google

It therefore follows that if a sum somewhat commensurate with the value of these franchises and privileges be received for them, a source of revenue has been established that will relieve the burdens of the taxpayer.

The streets and alleys of a city are the heritage of the people and should never be given away for the aggrandizement of any private corporation. Mayors and councils are merely trustees for the management of the business of a municipality, but they frequently act as if they themselves were the owners in fee simple to the public highways and had the right to dispose of them at will, giving away the valuable possessions of the people without any consideration of the rights of their immediate constituents or of the succeeding generations.

All the great public utilities of our municipalities should be retained in the hands of and under the management of the people themselves, and no private corporation in any American city should have any more right to control the water we drink than the air we breathe.

Many of the public utilities are and must be in the nature of monopolies. There can be no true competition in the furnishing of water, gas, electric lights, telephones, etc., and tramways are entering the same category. They are no longer luxuries, but actual necessities. The time should speedily come when all the great public utilities of our American municipalities will be owned and operated by the people themselves through the business administration of their municipal government.

Until this time comes, what remuneration should be paid for these great rights and privileges which are sought for so greedily in every portion of our land? In the construction of a street railway the city puts in the franchise and the right of way, the corporation the tracks, cars, power and machinery. It is a partnership, but the rights of the city partner are thereafter ignored. The city is not allowed any voice in the management of the road nor any consideration for its share of the partnership property.

For the franchise the city should receive the percentage of the gross receipts; for the right of way, the same rate of interest as the bondholders receive, the value of the right being determined by the value of the abutting land.

There was some little struggle over the secretaryship, at the annual election of officers, Mr. B. F. Gilkison being accused of violating the constitution, as to the receiving and paying out of League moneys. He was, however, elected by 29 votes, against 13 cast for J. H. Mahoney, president of the Indianapolis common council. Mayor Black, of Columbus, O., was chosen president; Mayor Taggert, of Indianapolis, was chosen treasurer, but resigned in favor of Mayor Taylor, of Bridgeport. The trustees elected were J. MacVicar, of Des Moines; J. H. Smythe, of Charleston, S. C., and C. S. Ashley, of New Bedford, Mass. The next place of annual meeting will be Syracuse, N. Y.

The Decreasing Demand for X-Ray Apparatus.

BY W. J. CLARKE.

DURING the first few months following the announcement of the discovery of the X-rays by Prof. Röntgen, it was found almost impossible to supply the enormous demand for induction coils and Crookes tubes. The coil makers of this country had a new problem to solve. While for years some of them had been manufacturing coils which were intended to be used only for a few moments in experimental work, none of them had ever dreamed of turning out coils that would withstand the severe work incidental to the production of the X-ray. Consequently it was but natural that many of the coils sold during the above mentioned period were found to be defective in many ways, but as usual in such cases the American inventor stepped to the front, and at the present day coils for X-ray work are being sold by several firms in this country, which we feel safe in saying are far superior to those manufactured by foreign firms who have given their entire attention to this work for many years.

The earlier form of Crookes tube was also defective in many ways, it frequently happening that the vacuum in these tubes would rise during an hour or two's use to such an extent that the coil would spark around the tube, and it would have to be re-exhausted before it was possible to use it again. In order to overcome this, tubes having an adjustable vacuum have been designed by several manufacturers, and for all ordinary work some of these tubes have proved themselves to be all that is to be desired. It is found, however, that they do not possess the powerful penetrating power of some tubes that are not provided with the adjustable vacuum arrangement, and consequently, a surgeon, in order to be properly equipped, should possess an adjustable vacuum tube for all ordinary examinations of the extremities, but for examining the denser portions of the body it is necessary that he should have another style of tube not provided with the adjustable vacuum device, and it is also necessary that this tube be worked up to a point of very high vacuum in order to secure the best results. Unfortunately, these results last such a very short time that it is necessary to be provided with a number of these tubes, especially as it is found that even when they are re-exhausted with the greatest care they never have the same penetrating power as when new.

When the discovery was first announced nearly every surgeon of prominence in the country made up his mind that it was absolutely necessary that he should have a complete outfit, but as it was some months before the manufacturers were able to produce reliable apparatus, a great many surgeons were more than discouraged with the results obtained from their purchases, and in addition to this, the price of the apparatus was held at an extremely high figure so as to place it beyond the reach of nearly all surgeons except those who had the good fortune to enjoy a lucrative city practice.

It has been my privilege to be brought in contact with nearly all of the manufacturers of X-ray apparatus in the country, and each one has unhesitatingly stated that the business has greatly fallen off during the past year, until at present but very few outfits are being sold. Now I think that this condition of affairs can be attributed to two causes. The first of these is the fact that although the apparatus now being sold in this country is far superior to that manufactured abroad, it is still much too complicated for the average physician or surgeon to handle it intelligently. As it has become pretty generally known among the profession that X-ray apparatus gives considerable trouble, it is but natural that they should defer purchasing as long as they possibly can, or until such time as some more easily operated apparatus is devised. The second reason why I think trade in this line is falling off very much is on account of the fact that the best apparatus is being manufactured by a few firms only, and they naturally, knowing that they have the best, are asking what seems to be an abnormally high figure for their output.

In the hands of an expert, almost any X-ray apparatus will give good service, as witnessed by the fact that at the recent Electrical Exhibition in the Madison Square Garden, the Exhibition Company's outfit was in continuous operation for nearly eight hours each day for over three weeks, and during that time not a single breakdown occurred, and only two tubes were used. At the same time, it is likely that the same outfit placed in the hands of a physician or surgeon would give considerable trouble even after a few hours' use. It seems clear to me, however, that in order to get the physicians interested again, and to push the X-ray business to the front, it is necessary to devise an outfit that will be compact, reliable, easily handled by a novice and sold at a reasonably low price. I can see no reason why an outfit of this kind cannot be manufactured and sold at the price of $100, which would bring it within reach of the entire profession, and I feel that until this is accomplished the trade in X-ray apparatus will remain at its present low ebb.

A Possible X-Ray Lightning Effect.

WE have received from Dr. G. J. Mack, of Waterloo, Iowa, a photograph of a lightning flash presenting a curious feature worthy of notice. At the lower left hand corner appears a 2 x 2 inch wooden clothes reel arm projecting into the picture. Two streaks of lightning seem to have passed between the wooden arm and the camera; at any rate, the parts of the lightning streaks which ordinarily would be hidden by the obstructing clothes reel show up directly through the wood, as if the latan X-ray effect. We doubt it.

Digitized by Google

Polarisation of Röntgen Rays.

This is one of the "X-ray Myths" exposed by Dr. S. P. Thompson. L. Graetz (Wied. Ann.) had the happy idea of endeavoring to produce X-rays readily polarized by letting the cathode rays impinge upon crystals. According to Sohncke, all fluorescing crystals send out polarized light. Graetz used calcspar, tourmaline, andalusite and dischroite. Now, if the Röntgen rays proceeding from these crystals were polarized, a single tourmaline crystal outside could be used as analyzer. The tourmaline tongs would be even more effective. Positive results appeared to be obtained on the screen, but photographs showed no trace of polarization, nor could it be detected with a Nicol. Further observations showed the apparently positive results to be due to inequalities on the fluorescent screen used for observation. It appears, then, that even with this most powerful means polarized X-rays canot be produced.

Testing the Purity of Coal by Means of X-Rays.

ACCORDING to "Engineering" Mr. M. H. Couriot recently suggested a novel use for the X-rays in a note communicated to the Paris Academie des Sciences. Professor Röntgen's discovery has already proved of great service in surgery, but Mr. Couriot suggests that the rays may prove as efficient in showing the intimate structure of siliceous skeleton of our coals as they are in defining the calcareous skeletons of animals. He states that by means of a powerful Crookes tube and a fluorescent screen, it is easy to determine the purity of a fuel. Carbon in all its forms is exceedingly transparent to the rays, whilst silica and silicates are opaque; and on placing a lump of coal between the tube and the screen, all the intimate details of the slag and clinker forming portions of the fuel at once appear. Mr. Couriot has tested in this way anthracite, coal, lignite, peat, coke and block fuel. The finest particles of silicate, though quite invisible to the eye, show up at once on the screen as dark spots or bands upon a bright ground. The differences in the quality of a series of coals can be traced step by step, showing at once the variations in the purity of the fuel. The conglomerate structure of block fuel is clearly exhibited, whilst with coke the particles of iron sulphide are indicated by black spots on the fluorescent image. Carbon is so transparent that it is unnecessary that the samples should be regular blocks, as rough lumps, the sides of which usually follow the natural planes of cleavage of the coal, serve perfectly well. Mr. Couriot has taken radiagraphs with specimens 1⅛ in. to 2 in. thick, the coil having a spark 10 in. long, and the exposure being five minutes.

LETTERS TO THE EDITOR

Preventing Collisions At Sea.

IT was with very great interest that I read the article of Mr. Hermann Herberts in the last issue of the Engineer, entitled "Means for Detecting the Presence of a Ship or Iceberg," and while the arrangement suggested by Mr. Herberts is certainly extremely ingenious and well worked out, I am, nevertheless, of opinion that the use of wireless telegraphy apparatus is the only successful way in which collisions at sea can be avoided.

Were it made compulsory for every seagoing vessel to be equipped with the necessary outfit, the demand for apparatus would be so great that its cost would be largely reduced, so that a ship could be fully equipped for a comparatively very small amount.

The arrangement of the apparatus would be such that when two ships approached each other a large vibrating gong would ring in each, and the transmitter could be so adjusted that this signal would take place at a distance of from one to ten miles, according to what was decided to be the most suitable distance at which such signals should be given.

I am of opinion that but very few people are aware as yet of the state of perfection to which wireless telegraphy apparatus has been brought in this country and feel quite sure that if the public were convinced of its reliability it would be but a very short time until its adoption for signaling on shipboard would be compulsory.

W. J. CLARKE,
General Manager U. S. Electrical Supply Co.

New York City, Aug. 3, 1898.

Shunt Method of Motor Control.

I AM reminded by the article and editorial on the Henry "Regenerative" Control in your July 21st issue of the Biblical promise that we shall all be born again.

As a contribution to history, it is in order to make reference to the following:

1st. Paper read in Boston at the meeting of the Society of Arts in December, 1885, setting forth somewhat fully the shunt method of operating railway motors, and the saving to be effected by returning current to the line by systems afterwards (about ten years ago) patented.

2d. Description of the experiments carried on for months on the Thirty-fourth street branch of the Manhattan Elevated Railroad, in the winter of 1886-7, in which these methods were put in practical test, and which tests were fully described in Martin and Wetzler's work on Electric Motors.

3d. The practice which has obtained for a number of years in certain classes of stationary and elevator work.

FRANK J. SPRAGUE,
Vice-President and Technical Director Sprague Elec. Co.

New York, August 1, 1898.

MR. HERMANN HERBERTS, of Newark, N. J., whose method of detecting the approach of a ship or iceberg at sea was illustrated in our columns last week, has been very much encouraged by a number of letters he has received on the subject. He is taking the matter up in real earnest, and has proposed the appointment of an international commission, whose duty it shall be to investigate and report on the various methods proposed for insuring the safety of vessels during a fog.

SOCIETY & CLUB NOTES

The American Street Railway Association.

The following is a list of the topics and authors for the annual meeting in September of the above association:

"Maintenance and Equipment of Electric Cars for Street Railways," by M. S. Hopkins, electrician, Columbus Street Railway Co., Columbus, O.; "To What Extent Should Railway Companies Engage in the Amusement Business," by W. S. Holmes, general manager Metropolitan Street Railway Co., Kansas City, Mo.; "The Carrying of United States Mail Matter on Street Railways," by W. S. Dimmock, general superintendent, Omaha and Council Bluffs Railway and Bridge Co., Council Bluffs, Ia.; "The Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," by Richard McCulloch, electrical engineer, Cass Avenue and Citizens' Railway Co., St. Louis, Mo.; "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," by Frederick H. Perkins, electrical engineer, Toledo Traction Co., Toledo, O.; "Cost of Electric Power for Street Railways at Switchboard; Both Steam and Water," by R. W. Conant, electrical engineer, Boston Elevated Railway Co., Boston, Mass.

Ohio Electric Light Association.

This excellent association holds its annual meeting at the West House, Sandusky, O., August 18 and 19. Secretary Scovil reports a good programme with several useful papers by well-known engineers and lighting managers; and the Sandusky Lighting Co. has laid out a choice programme of entertainment.

SYRACUSE, N. Y. The Merchants' Association of New York advocates special attention being paid to the annual State Fair at Syracuse, given by the New York State Agricultural Society, of which Hon. B. F. Tracy, ex-Secretary of the Navy, is president. The fair is held the last three days in August, and the first three in September. A good electrical exhibit is expected.

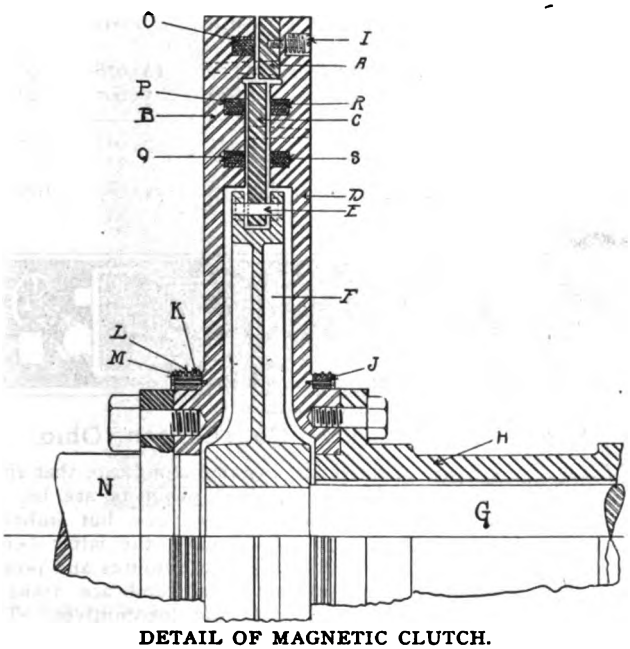
Digitized by Google

MISCELLANEOUS

Magnetic Clutch For Heavy Station Work.

IN the course of a very interesting paper, read at the recent Omaha meeting of the A. I. E. E., on a modern central station, namely that of the Imperial Electric Light, Heat and Power Company, of St. Louis, Mo., Mr. George A. Damon described the "Arnold System" of connecting engines and generators[1], which had been adopted in this plant. This system of power station design is well known, but as applied in this instance it embodied several novel features, not the least interesting of which is the coupling device or clutch, described below, it being the first magnetic clutch applied upon a large scale to power station work.

The figure shows a cross-section of the clutch. One part, B, is bolted to the engine flange, N. A corresponding part, D, is bolted to the generator quill, H, and this part carries an annular armature, A. Radial arms F, keyed to the solid shaft G, carry an interior armature C. Each coupling is provided with five circular coils of magnet wire, O, P, R and S. These coils are electrically connected to contact rings J, K and L, carried on insulating bushings bolted to the hubs of the clutch.



DETAIL OF MAGNETIC CLUTCH.

Stationary brushes which are connected through a system of switches to the storage battery 'bus-bars make it possible to send a current around any coil. The parts of the clutch containing the coils are made of cast-steel of high permeability so that when a current is sent around any coil, the surrounding metal becomes a magnet and the armature facing the coil is immediately magnetically attracted. The two surfaces of the clutch parts being held in contact by a pressure of at least 80 pounds per square inch, it becomes possible to transmit power from one to the other. Thus to connect engine shaft N to generator quill H, a current is sent through coil O in that part of the clutch B attached to the engine shaft. Armature A which is attached by means of strong studs to that part of the class B which is securely bolted to the generator quill, is immediately attracted and overcoming the small resistance of the spring G, the two parts become firmly attached to each other, making it possible to run the generator from the engine. If it is desired to revolve the interior shaft by means of the engine, the current is sent through coils P and Q in parallel, attracting armature C, while if the solid shaft is being turned by the other engine and it is desired to connect the shaft to the generator quill, then coils R and S are energized and the armature C is attracted in the other direction. The circuits to these coils are all controlled by means of switches on the main switchboard. These switches are so arranged that when the circuit of any coil is broken, the discharge of the extra current is taken up through a carbon resistance, and the insulation of the coil is therefore protected from the liability to puncture. When the current in any coil is discontinued, spiral springs have been provided to overcome the residual magnetism and bring the armature back to its original position.

If both parts of the clutch which are to be attached are stationary, the connection becomes an easy matter, but if one part is revolving, it becomes necessary to put the other part in motion before the current is sent through the coils. This is accomplished by starting the dynamos as motors and bringing them up to speed before closing the magnet coil switch. For this purpose, regular starting boxes have been installed, one for the boosters and the other for the generators, so that any machine may be thrown into or out of service directly from the switchboard. The result of the whole arrangement is, that a number of combinations between the engines and the generators become possible. Under all normal running conditions, the centre engine will run its two adjacent generators and the outside engines will operate the end generators. Eacn booster may be run when necessary, from either of two engines. The entire line of machinery may be connected together, so that all the engines and generators operate in unison as one large unit, the speeding attachment on the engines making it possible to operate them satisfactorily in this manner.

In case of accident to any generator that particular machine may be stopped without stopping its corresponding engine, and the electrical load will be immediately taken up by the other generators, but without overloading the engines. In case of accident to any engine, the ability of the other engines to carry an overload of 100 per cent. may be taken advantage of, if necessary, without overloading any of the generators. Thus the centre engine is capable of carrying all four of the generators fully loaded while the smaller end engines can operate two of the generators, if necessary, in case of a break down of the larger engine. The plant may, therefore, operate at period of maximum load, at its full rated capacity, depending entirely upon the advantages of the system of arrangement for a reserve in case of a breakdown to any part of the equipment.

[1]Electrical Engineer, May 16, 1894, and May 27, 1896.

POWER TRANSMISSION

Concentration of Power by Electric Transmission at Taunton, Mass., Tack Works.

ONE of the most forcible of the advantages of electrical transmission of power is that this method often makes it possible to combine two or more steam plants into one, greatly diminishing the cost of labor and supplies. Such an advantage appeals especially to the mill owner, who may operate shafting in several buildings and departments by separate sources of power. A conspicuous example of a wasteful arrangement is in the works of one of the largest locomotive shops of the country, where part of the plant is operated by water power, part by steam power, and part by compressed air, the latter necessitating an extra engine and compressor.

Electric transmission, and notably the polyphase system, as developed by the Westinghouse Company, has made it possible to centralize the power in such shops. When Lieut. L. O. Garrett took charge of the affairs of the Atlas Tack Co., of Taunton, Mass., as manager, he instituted a thorough investigation as to the power required for the various classes of tack making machinery under normal conditions. The mills of this company at Taunton are three in number, located from 800 to 1,200 feet apart, and were until recently operated by three separate steam plants, with the accompanying wastefulness incident to small units. It was found that owing to variations in the amount of power required from day to day for the different classes of work, the duty of the three steam plants could be easily performed by a single steam plant of two-thirds their united capacity.

Digitized by Google

So large a saving in coal and labor as was expected from this arrangement induced Lieut. Garrett to engage the services of Mr. T. W. Sprague, of Boston, Mass., to investigate jointly with him the various systems of transmission. The parties interested inspected personally a number of the principal polyphase plants among the New England mills, and finally selected the Westinghouse three-phase system, 3,600 alternations, as best adapted to the work of the Atlas Tack Co. This system, in connection

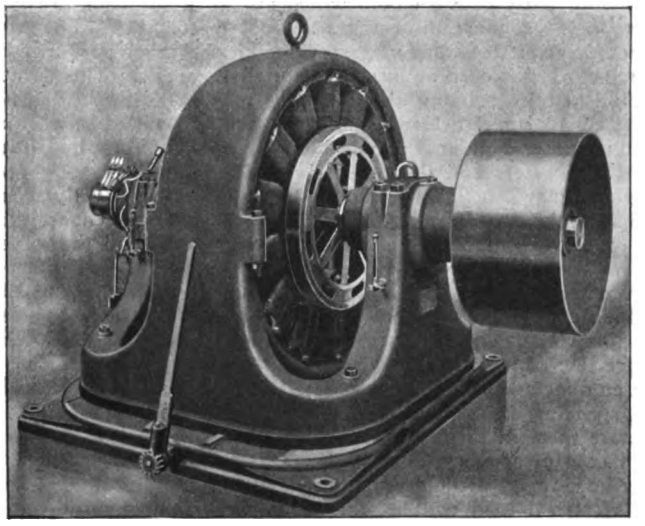


FIG. 1—150 K. W. WESTINGHOUSE GENERATOR.

with the Tesla "Type C" motors, made by the Westinghouse Electric and Manufacturing Co., has attained marked success in every instance in which a plant has adopted it, and the alternate current motor, though developed later than the direct current motor, has been favorably received in all such installations.

The Atlas Tack Co. are to use a 150-kilowatt Westinghouse generator, shown in Fig. 1, which will operate 9 Tesla induction motors of the above type, shown in Fig. 2, ranging from 3 to 50 horse power, in the various mills. The gas lighting system of the mills will be replaced by about 1,000 incandescent lights.

The company instituting these changes is one of the most progressive of manufacturing concerns, employing over 500 men,

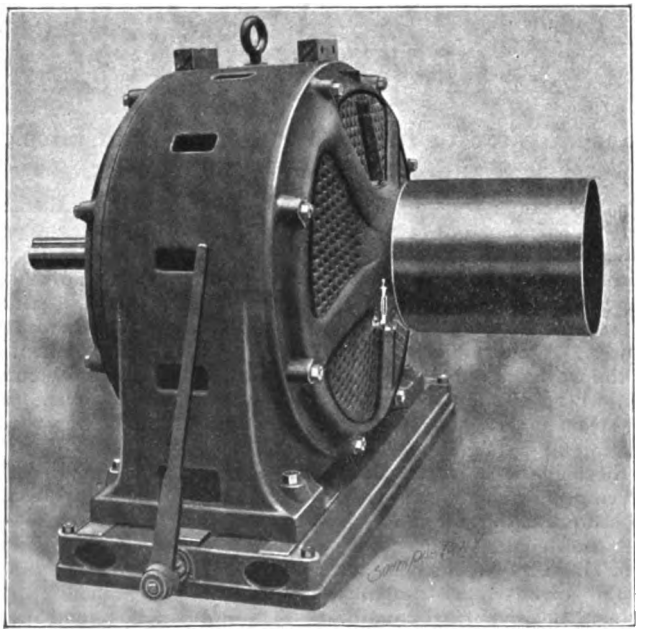


FIG. 2.—TESLA INDUCTION MOTOR.

and making some 10,000 brands of tacks, rivets, etc. Considerably over 50 per cent. of all the tacks and rivets made in the United States are produced at their shops, and their electrical equipment will be watched with interest, and no doubt imitated by many other concerns of the kind.

The adaptability of the "Type C" motor, as made by the Westinghouse company, to so many varied fields of usefulness, has surprised many, who have possibly been prejudiced against the alternating current motor; but the cause of their surprise constitutes one of the strongest proofs of the reliability of this new Westinghouse product.

QUEBEC, CANADA. Plans are on foot for the utilization of the Shawinigan Falls, in the Province of Quebec, near the city of Three Rivers. There is a fall of 165 feet, and it is said 200,000 h. p. can be developed. A charter has been granted to the Shawinigan Water and Power Co.

REPORTS OF COMPANIES

Bell Telephone Output.

The American Bell Telephone Co. made a good addition to total instruments outstanding in licensees' hands under rental for the month ended July 20, as the following figures show:

July—	1898.	1897.	1896.	1895.
Gross	21,551	15,859	12,584	13,837
Returned	10,011	7,241	10,490	7,513
Net output	11,540	8,618	2,094	6,324
Dec. 21 to July 20—				
Gross	187,884	127,778	126,678	98,896
Returned	83,306	51,847	53,667	47,121
Net output	104,578	75,931	73,011	51,775
Total outstanding July 20	1,023,699	848,558	747,987	625,450

MECHANICAL

Wrought Iron Bridge Co., Canton, Ohio.

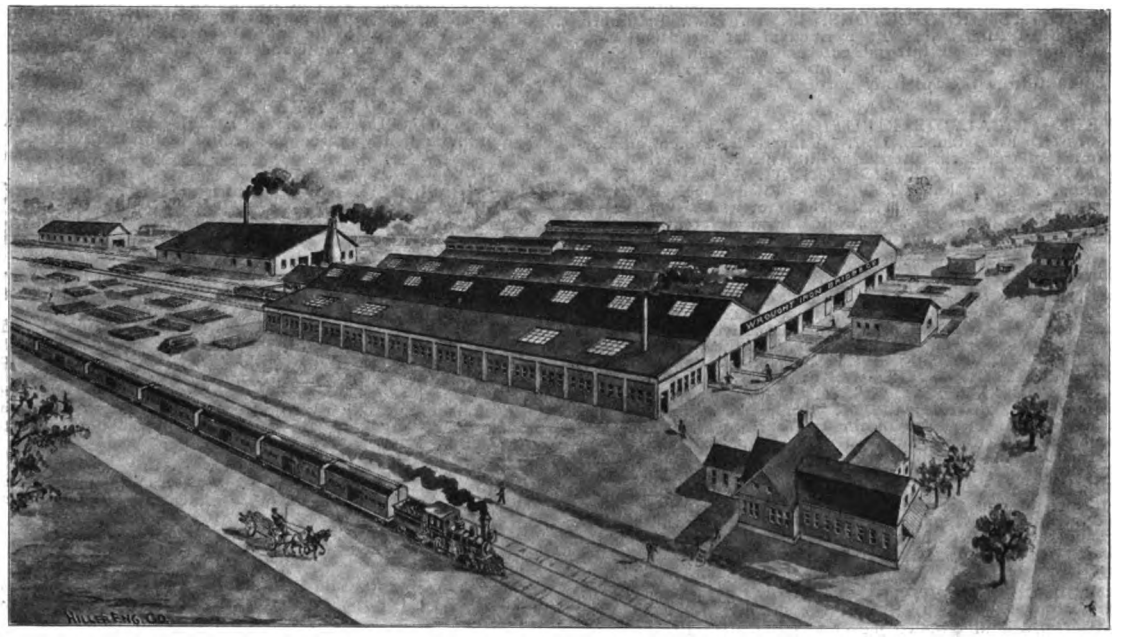
WHILE the name of this company might indicate that they only deal in bridge work, their products are by no means confined to steel structures of this class, but embrace building material, viaducts and roof trusses, the latter being especially adapted to the requirements of car houses and power and lighting stations. The products also embrace transfer tables, and turntables for steam cars and locomotives. The works occupy a tract of twelve acres situated in the southwest part of Canton, and connected by switch tracks with a number of railroads, giving excellent receiving and shipping facilities. The works employ about one hundred men.

A distinctive feature of the plant is the employment of electric motors for the operation of the individual tools and for this this purpose twenty-one motors are employed, ranging from three to twenty horse power. These are supported by the roof members, and the power is transmitted to the tools by vertical belts. The cost for maintaining the motor equipment together with the material for repairs is said to be less than $100 per year —a degree of economy that could not possibly be met with shafting and the ordinary methods of power transmission. The material, consisting of steel bars of all dimensions, is delivered on steam cars to the storage yard or stock house, which is a separate structure, and from which by means of narrow gauge trucks the material is conveyed to the structural shaft according to the demands. The whole floor and the main shop is provided with skids having metal plates on the top, and these are arranged systematically in rows across the building with the tools, including punches, shears and drills, conveniently located and arranged in consecutive line from east to west across the shop. There are also rolls and pulleys on which the material is readily moved to or from the tools. The material first enters the shop on the north track and is unloaded upon the adjacent skids, where it is laid off from templates and marked for punches

Digitized by Google

and shears, then from these machines to straightening machinery or curving rolls, then to assembling skids, and from there to the reaming tools. These tools are of novel design and are known as the Ross reamer. These are arranged in a straight row across the shop above the line of skids, there being from fifteen to twenty separate tools. These are each operated by means of a vertical shaft about 18 feet in length, which is driven by beveled gear from a main horizontal overhead shaft. The vertical shaft is telescoped for a part of its distance, a square shaft being let into the hollow of the round shaft and this shaft is provided with two universal joints, one near the top end and one other near the tool. By means of levers and the clutch the shaft is started and the reaming tool which has a range of several feet in any direction and at any angle is inserted in the rivet holes and quickly reams them to the proper size, all punched holes being thus reamed.. The material next goes to a riveting machine, and for this purpose four pneumatic reamers of different capacity are employed. These are all in one line, and are manipulated by being suspended by hand hoists from an overhead trolley car, giving a large range for action and providing for quick work. For heating the rivets four open hearth furnaces, in which oil is employed for fuel, are located in close proximity to the pneumatic riveters and near the middle of the floor. The hot rivets are passed through the machines by boys and are headed by the riveters about as fast as one can count. Next comes planing mills and drills for special work where some finish is required on parts that are not readily accessible, and for this more or less hand riveting is required. There are also two single-headed milling machines for column work, by means of which the top or base of the column is dressed to any angle. The largest of these tools is a disc about three feet in diameter while the cutting tools are inserted in the face. This is mounted on a swiveled base and there is an idler for supporting columns of any length. The material while undergoing these various operations has passed in a zigzag course from north to south, arriving in a finished condition ready for painting, when it is loaded directly on the cars for transportation or is directed to the storage for finished material. For shipping, the main switch track enters the shop on the south side on tracks depressed four feet below the shop floor, so that the operation of painting as well as the loading of cars can be carried on regardless of the weather. The bridge work is not confined to truss and girder structures entirely, but large sheet metal tubing is also constructed for bridge piers, designed to be filled with concrete when in place. In the forging and blacksmith department there are four forges, one furnace, one large steam hammer, and a bolt and rivet making machine. There are also thread cutters for cutting rods of any size. Here the loops and links in the ends of long rods designed for lower cords and diagonals are forged by hand. The wood working machinery and tools for making templates and patterns occupy a room on the north as described above. The steam equipment occupies a brick building 30 by 50 feet adjoining the east side of the main structure. The boiler is of the Hazleton type and is equipped with Murphy stokers. A Russell engine with cylinders 13 x 20 inches and rated at 100 horse power furnishes power for driving three generators, one for power and the other two for arc and incandescent lighting. It also drives a 10 x 12 inch two-stage Norwalk air compressor for operating the riveting machines in which 100 pounds of pressure is employed. The building is heated by the Sturtevant hot air system, there being a chamber containing coils of pipe over which the air is blown by means of a fan, whence it is led about the structure through large galvanized iron pipes supported in the roof members, from which numerous branch pipes deliver the blast to all parts of the building.

The main office and draughting department occupy spacious quarters in a separate building, together with suitable offices for the clerical department. Here are found the usual equipments of office, fireproof vaults, and appliances for conducting the accounting and draughting departments. The affairs of the company are conducted by the following officers: F. M. Wyant, treasurer and general manager; E. J. Zander, chief engineer; W. P. Hall, superintendent.



FACTORY OF THE WROUGHT IRON BRIDGE CO., CANTON, OHIO.

Peace and Prosperity.

Spain has accepted our terms, and it would now appear that the cessation of hostilities is about to take place. Such a condition would in itself bring about a better feeling in business, but all the other conditions are likewise favorable. July has just closed with the largest bank clearings for that month in the history of the country. Crop indications are even better than they were, making the third good harvest in succession, and the iron and steel situation has materially improved. Business failures are at low ebb, being only 189 for the week, as compared with 214 a year ago. Nearly all lines of distributive trade are brisk, and the summer dullness already draws to its close.

In the stock market, there is a distinct upward tendency, and the sales of bonds have been remarkably large. During the

Digitized by Google

week 26,125 shares of Western Union were sold, rising to 94¼. General Electric was stronger, with sales of 12,450 shares, up to 40¾. New York Edison was firm at 131. In Boston, American Bell Telephone was up around 280.

Copper. New York is steady at 11.50 cents. Heavy steel rail, Eastern mill, is quoted higher at $17.75.

Classified Digest of U. S. Electrical Patents Issued July 19, 1898.

Batteries, Secondary:—

GALVANIC CELL. A. Heil, Fränkisch Crumbach, Germany, 607,590. Filed Dec. 1, 1897. Comprises a carbon electrode surrounded by about equal parts of graphite, manganese, peroxide, and lead peroxide; a zinc electrode and an absorbent filling holding an electrolyte of zinc sulphate containing flocks of hydrate of zinc evenly distributed throughout the mass of the electrolyte.

Conductors, Conduits and Insulators:—

BOND FOR ELECTRIC CONDUCTORS. S. W. Huff, Baltimore, Md., 607,746. Filed Aug. 29, 1896. Formed of flat metal and comprises a body portion of an integral external extension bent about an axis transverse to the body portion into a tubular attaching-lug projecting laterally from the flat body portion.

Distribution:—

SYSTEM OF ELECTRICAL DISTRIBUTION. B. G. Lamme, Pittsburg, Pa., 607,621. Filed Jan. 28, 1897. A three-wire system employing transformers to transform alternating into direct current.

CIRCUIT ARRANGEMENT FOR ELECTRICAL APPARATUS. J. Meisler, Vienna, Austria-Hungary, 607,760. Filed Dec. 13, 1897. Means whereby a number of electrical circuits or separate pieces of apparatus may be simultaneously controlled from different positions through the medium of any one of a number of circuit controlling devices.

Dynamos and Motors:

ELECTROMAGNETIC MOTOR. A. B. McMillan, New York, 607,451. Filed July 7, 1898. Comprising a motor having an armature and field magnet, and a secondary armature acted upon inductively by a rotating field of force produced by the rotating element of the motor.

DYNAMO ELECTRIC MACHINE. W. B. Sayers, Glasgow, Scotland, 607,593. Filed eDc. 21, 1897. Details of construction.

FIELD MAGNET FOR ELECTRIC MACHINES. S. H. Short, Cleveland, Ohio, 607,609. Filed May 4, 1896. Comprises a series of laminations, whereby the continuity of the end surface of the cores is broken, combined with a ring of magnetic material arranged to surround the armature end of each of the cores.

DYNAMO ELECTRIC MACHINE. A. G. Eigner, St. Petersburg, Russia, 607,737. Filed May 7, 1898. A field magnet for dynamo electric machines, formed of separate complemental members joined together, each of the members having projections cooperating with the projections of another member to form complete polar projections, the members being separated to form slots in the polar projections.

Electro-Chemistry:

APPARATUS FOR PRODUCING ALKALI METALS FROM THEIR CHLORIDS. P. Danckwardt, New York, 607,506. Filed Jan. 4, 1898. Consists of a double-walled jacket forming a positive compartment, means for passing a current of water through the jacket, and anodes within the compartment, and an iron box open at one side and forming a negative compartment, the box communicating at its open side with the positive compartment.

ELECTROLYTIC BATH. P. Marino, Paris, France, 607,646. Filed Dec. 1, 1896. Consists in adding to a solution of a salt of the metal to be deposited alkali-metal salts of the same acid and an alkali-earth-metal salt of another acid in such quantity as to give by an incomplete double decomposition, an insoluble precipitate and a mixed solution of different soluble salts of the metal to be deposited, and electrolyzing the mixed solution.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. J. H. J. Haines, New York, 607,598. Filed Oct. 29, 1896. Employs a detached tilting clutch freely movable about its axis and provided on its inner periphery with rotary friction devices.

Measurement:

VOLTMETER. J. F. Stevens, Philadelphia, 607,715. Filed April 22, 1897. Consists of a resistance coil connected in shunt across the terminals of the working coil, and provided with a core and casing of iron which forms a magnetic circuit, the amount of iron being sufficient not to be saturated by the current passing through the instrument.

Miscellaneous:—

APPARATUS FOR CLEANING PAINT FROM SHIPS. W. P. Freeman, New York, 607,794. Filed June 22, 1897. A reciprocating tool-bar, and electric motor therefor, a tool-bar extending transversely to the shaft of the motor, through the field magnet and the field-magnet coils.

ELECTRIC STOP-MOTION FOR LOOMS. A. Stephens, Guadalajara, Mexico, 607,714. Filed June 26, 1897. Details of construction.

PROCESS OF AND APPARATUS FOR PRODUCING RELIEFS IN METAL. J. Rieder, Munich, Germany, 607,484. Filed Dec. 21, 1897. Employs electrolysis.

ELECTRIC BUOY. E. W. G. C. Hoffman, Charlottenburg, Germany, 607,745. Filed May 28, 1896. Details of construction.

Railways and Appliances:—

ELECTRIC RAILWAY SYSTEM. S. H. Short, Cleveland, Ohio, 607,610. Filed May 24, 1897. Surface contact system. Details of construction.

ELECTRIC RAILWAY SYSTEM. S. H. Short, Cleveland, Ohio., 607,611. Filed July 9, 1897. Waterproof surface contacts.

TROLLEY BASE. H. G. Taylor, Montreal, Canada, 607,612. Filed Sept. 27, 1897. The base is pivotally mounted, the pole is held in an upright position by means of springs, and a buffer is provided to hold the pole when leaving the wire.

ELECTRIC RAILROAD. C. A. Myers, Atlantic City, N. J., 607,697. Filed Nov. 18, 1897. A track rail, comprising two sections, spaced apart and forming opposite walls of a conduit the tread of one section being below the plane of the other section-tread, an insulating material arranged in a groove in the under side of each section-tread, and conductors for electricity, supported by the insulating material.

Regulation:—

REGULATING SWITCH FOR ELECTRIC CIRCUITS. H. P. Davis, Pittsburg; and G. Wright, Wilkinsburg, Pa., 607,617. Filed Sept. 18, 1897. Particularly designed for raising and lowering the electromotive forces in alternating current circuits.

Switches, Cut-Outs Rheostats, Etc.:—

ELECTRICAL RESISTANCE. H. S. Chase, Boston, Mass., 607,540. Filed Jan. 11, 1897. Rheostat of the "enamel" type.

ELECTRIC REGULATOR. J. A. Powers, Lansingburg, N. Y., 607,551. Filed Oct. 28, 1897. A variable resistance, comprising two receptacles containing a conducting solution and communicating at different levels, means for cooling the solution in one receptacle, separable plates in the other, and a solenoid and core for varying the distance between the plates.

RHEOSTAT. M. J. Shiels, Westfield, N. J., 607,608. Filed Jan. 7, 1898. The resistance coils are embedded in cement and the cement enclosed with a metallic casing designed to radiate heat.

ELECTRIC LINE SWITCH. A. B. Du Pont, Detroit, Mich., 607,638. Filed Aug. 12, 1897. Comprises a pivoted tongue, a magnet and spring for controlling the position of the tongue, a ribbed section, connected through the magnet-coil with the main conductor, at each end of the tongue, and roofs protecting the tongue, ribbed sections and magnet.

CONTROLLER. T. Von Zweigbergk, Cleveland, Ohio, 607,672. Filed April 8, 1898. A blow-out for controllers, composed of a series of coils standing in the space between the contacts and adapted to be connected in a circuit and throw their lines of force directly through the contacts.

Telephones:—

LONG DISTANCE TELEPHONE. P. De Kilduchevcky, London, Eng., 607,801. Filed Feb. 10, 1897. Embodies an attached lining of granular non-hygroscopic material in the transmitter.

Classified Digest of U. S. Electrical Patents Issued July 26, 1898.

Alarms and Signals:—

METALLIC GATE-SCREEN. A. P. Prichard, Tacoma, Wash., 607,877 Filed Sept. 9, 1897. A screen for vaults, safes, etc., employed to establish an electric circuit and sound an alarm.

RAILWAY SIGNAL SYSTEM. G. T. Cunningham, Boston, Mass., 608,031. Filed Nov. 13, 1897. Details of construction.

ANNUNCIATOR GAS FIXTURE. J. L. Bixby, Arlington, Mass., 608,100. Filed Nov. 26, 1897. Comprises a cock having a passage connecting its inlet and outlet; a valve controlling that passage; a spring plunger controlling that valve, and a cam to move the plunger and automatically hold it when in its elevated position, against the force of its spring.

Batteries, Secondary:—

SECONDARY BATTERY. G. Walter, Strasburg, Germany, 608,015. Filed Aug. 19, 1897. An instrument for removing detached material from storage batteries, consisting of a box-shaped spatula with a handle, and with ridges extending crosswise of the box, the rear side of the box being closed and the lower end being in the form of a thin flat wall.

Conductors, Conduits and Insulators:—

INTERIOR CONDUIT. E. E. and F. W. Erickson, Boston, Mass., 607,989. Filed June 3, 1898. Comprises an outlet box having its bottom and sides formed from a single piece of thin metal sheet, cut at its corners to provide lapping joints; with a metal brace riveted to each of the lapping joints, having a screw thread in its upper end, and a metal cover having a central opening surrounded by an outwardly projecting flange.

Dynamos and Motors:—

MEANS FOR PREVENTING STRAY MAGNETISM IN DYNAMO ELECTRIC MACHINES. J. F. Kelly, Pittsfield, Mass., 608,133. Filed May 27, 1898. Embodies an energizing coil and a magnetic part within the influence of the coil, in which the coil sets up a magneto-motive force, combined with a coil surrounding the part, and adapted to produce therein a magneto-motive force which neutralizes and prevents the passage through the part of the magnetic flux produced by the first force.

COMMUTATOR BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES. R. Lundell, New York, 608,135. Filed Feb. 4, 1898. A brush holder having adjacent brushes rigidly clamped against conducting pieces, which permit them to abut against each other, the conducting blocks in turn being securely fastened to an arm by means of flexible springs.

ELECTROMOTOR FOR ELECTRICALLY PROPELLED VEHICLES. A. Siemens, London, Eng., 608,137. Filed Nov. 18, 1897. The pole pieces are arranged partially separate from the limbs of the field magnets and so that they can be readily removed to give access to the armature.

Electro-Therapeutics:—

MAGNETIC ORE SEPARATOR. G. J. Crean, Montreal, Canada, 607,984. Filed Jan. 7, 1898. Comprises a series of stationary magnets arranged in the form of an arc; a hopper located adjacent to the magnets; a rotatable carrier adapted to travel across the surface of and in close proximity to the magnets and intermediate of same and the hopper, and being adapted to receive movement from the ore particles running from the hopper and adhering to it.

Lamps and Appurtenances:—

ELECTRIC LIGHT FOR SURGICAL PURPOSES. W. E. Dow, Braintree, Mass., 608,109. Filed March 26, 1897. Comprises a head-band, a reflector carried thereby, a condensing lens supported in front of the reflector, a lamp mounted between them, and means to adjust the lamp forward or backward relatively to the reflector.

Measurements:—

ELECTRICAL MEASURING INSTRUMENT. G. K. Elphinstone, London, England, and A. C. Heap, Penn, England, 607,921. Filed

Digitized by Google

May 13, 1898. Comprises an electro-magnetic core, primary windings disposed thereon, a secondary winding, a swinging coil mounted between the poles of the core, and included in closed circuit with secondary winding, and an indicating device operated by the swinging coil.

ELECTROSTATIC MEASURING INSTRUMENT. J. F. Kelly, Pittsfield, Mass., 608,132. Filed April 14, 1898. An electrostatic meter having fixed and movable vanes, a vane electrically connected to a conductor carrying electrical energy, and embedded in a dielectric to prevent creeping of the charge.

Miscellaneous:—

ELECTRIC SOUNDING DEVICE FOR SHIPS. J. P. Buckley, New Orleans, La., 608,104. Filed Dec. 11, 1897. Consists of a sounder adapted to be projected in advance of a ship, an alarm device on the ship, and electric wires connecting the sounder with the alarm device, and a float adjustable on the wires.

BICYCLE LOCK. F. V. Walstrom and J. Erickson, Chicago, Ill., 608,-163. Filed May 13, 1897. Comprises a locking mechanism, an alarm separate from the lock, but electrically connected therewith, and a contact device at the lock adapted to be operated by the bicycle upon its insertion.

Railways and Appliances:—

CROSSOVER FOR TROLLEY SYSTEMS. C. E. Davis, Chicago, Ill., 607,918. Filed Nov. 21, 1896. Details of construction.

ELECTRIC TRAMWAY. A. Diatto, Turin, Italy, 607,919. Filed Dec. 1, 1896. Surface contact system.

ELECTRICALLY SELF-PROPELLING VEHICLE. L. Krieger, Paris, France, 607,997. Filed March 11, 1897. Comprises steering wheels pivotally journaled upon opposite ends of a stationary axle, an electric motor connected to each wheel, and means for varying the speed of either motor to steer the vehicle.

INSULATED RAIL JOINT. G. A. Weber, New York, 608,088. Filed Nov. 5, 1897. Details of construction.

Switches, Cut-Outs, Etc.:—

DEVICE FOR OPERATING ELECTRIC SWITCHES. J. H. Cary, Springfield, Mass., 607,830. Filed Jan. 8, 1896. Especially applicable to telephone systems where it is desired to provide an individual call for separate stations upon the same line.

REVERSING RHEOSTAT. I. E. Storey, Philadelphia, Pa., 608,018. Filed January 29, 1898. Comprises a rotary shaft carrying a crank disc, an abutment on the disc, a toggle lever bearing at one extremity against the abutment and pivoted at a fixed point at the other and a spring connected to the toggle joint.

ELECTRICAL CIRCUIT CONTROLLER. R. Lundell, New York, 608,134. Filed Feb. 1, 1898. A circuit breaker consisting of electro-magnetic means for interrupting an electric circuit, in combination with means controlled by the movable part of the circuit breaker, and adapted to force a blast of air around the circuit breaking contacts.

Telephones:—

MICROPHONE. T. J. Howell, London, Eng., 607,994. Filed Jan. 8, 1898. Consists of a honeycomb disc having a series of cells, diaphragm, a screw down cover to hold the diaphragm in place in front of the honeycomb disc, a rear plate extending across the series of cells in the disc and a conducting spring for forcing the rear plate with the honeycomb disc forward as a whole, the cells being filled with carbon granules.

ELECTRIC TELEPHONE SYSTEM FOR HOUSES. L. Plaut, New York, 608,076. Filed Sept. 9, 1897. A simplified house telephone for private and apartment houses, by which the speaking tubes and call bells may be dispensed with.

CATALOGUES.

Western Electrical Supply Co.

THE general catalogue of the Western Electrical Supply Co., of St. Louis, Mo., which has just issued from the press and is being distributed among the trade, certainly comes up to the expectation of every one who has seen the advertisement of the same in the various electrical periodicals. It is one of the most complete electrical supply catalogues ever issued, and the company deserve great credit for issuing a book of so much value and so exhaustive in every detail. The catalogue, which contains 753 pages, measures 7x10½ inches, and is handsomely bound in a green cloth cover, plainly but artistically ornamented. It has been the intention of this company to compile a catalogue of standard goods, and while it is well known that they are in a position to furnish everything electrical that the market affords, still their experience has induced them to believe that the assortment shown in this catalogue covers quite completely the lines best suited to the needs of their numerous customers. Special attention is called to the fact that while they carry in stock the products of many of the leading manufacturers, they are agents for several prominent makers of electrical merchandise, such as the Stanley Electric Manufacturing Co., Eddy Electric Manufacturing Co., John A. Roebling's Sons' Co., India Rubber and Gutta Percha Ins. Co., the Ohio Brass Co., Adams-Bagnall Electric Co., North British Wire Manufacturing Co., and others.

The first portion of the catalogue is devoted to a description of electrical apparatus and machinery for lighting and power purposes. Numerous beautiful half-tone illustrations of various types of direct and alternating current machines are shown. There are interesting chapters on the coupling of generators, switchboards, alternating current motors and transformers and a lengthy chapter on the application of electric motors for household and factory purposes. Fan motors are described next in order, and a great variety of them are listed. Following this are a number of pages devoted to arc lamps of every description, and full page illustrations accompany the text. Incandescent lighting is the title of the next chapter of this beautiful book, and electric light supplies and switchboard apparatus, as well as switchboards themselves, are included therein. Dynamo brushes, carbon holders and other apparatus are next described, and then follows a chapter on rubber goods, insulating fibres and compounds. Fuse wires and other insulating specialties form the next chapter. Then follow in order sections on the following subjects, each one being a complete catalogue on the subject of which it treats: Electrical heating supplies, testing instruments, construction material, tools and appliances, electric railway supplies, telegraph supplies, telephone and accessories, electric house goods, electric and combination fixtures and leather belting. The last few pages of the book are devoted to an index to trade numbers and one to code words, a very exhaustive index of all appliances shown in the catalogue. A confidential trade discount sheet, numbering 24 pages, accompanies the catalogue when sent to the trade.

As may be imagined, there has been a steady demand for this exhaustive treatise, and while a large edition was published by the company, it is likely to be exhausted within a short time, and any one who wishes to place this valuable book on his shelf had better write for it at once, so that he may not meet with disappointment. We congratulate the company on the enterprise, and trust that this work will prove of as great benefit to them as it certainly must to their customers and the trade in general.

Chambersburg Engineering Co.

Catalogue No. 23, entitled "Hydraulic Machinery," has just been issued by the above company, of Chambersburg, Pa., having an office at 39 Cortlandt street, New York, and one in the Park Building, Pittsburg, Pa. This catalogue contains illustrations and descriptions of a number of hydraulic machines of the company's most recent designs, such as hydraulic riveters, cranes, accumulators, etc. The company also manufacture steam hammers of any desired size, pneumatic machines and steam engines, all of which are described in separate catalogues, which will be sent to any one on application.

Patterson, Gottfried & Hunter.

A special catalogue treating of tapping machines has just been issued by the above company, of 146-150 Centre street, New York, and adds one more to the very useful and instructive machine tool catalogues issued by them. It contains descriptions and illustrations of tapping machines of various sizes and styles manufactured by the numerous companies which this firm represents, and must prove of value to any one owning machine shops or installing machinery of this kind.

Metropolitan Injectors.

The Hayden & Derby Manufacturing Co., 111 Liberty street, New York, are sending out their very beautiful 1898 catalogue, which is a splendid reference book on the subject above mentioned. Several new features have been introduced, giving the horse power not only on the basis of 7½ gallons of water per horse power per hour, which has always been the standard basis of figuring the horse power of injectors, but also giving the horse power on a basis of thirty pounds variation of water per horse power per hour. The catalogue also shows for the first time injectors with flange, as well as screw connections, and all the various forms of injectors which the company manufacture are shown in dimension diagrams, which enables one to lay out a piping from the data given. The catalogue further describes new forms of ejectors, hot water heaters and special injector fittings. The catalogue will be sent to any one on application.

The Bergmann-Elektromotoren and Dynamo Werke Aktiengesellschaft, of Berlin, inform us that they have removed their offices to their newly-erected factory, No. 23 to 24 Oudenarderstrasse, near the Seestrasse, Berlin N. The company maintains only its show rooms at its former address, Berlin C, Spandauerstrasse, 16.

Digitized by Google

TRADE NOTES AND NOVELTIES

Gold's Improved Electric Car Heating Apparatus.

PROMINENT by its merits and sucess, the electric heating apparatus of the Gold Street Car Heating Company, of New York and Chicago, is still being developed and perfected, and its advance is a matter of general interest to the community, the heating art being a matter of novelty and one in which very few manufacturing concerns have had any experience worth considering. The heaters manufactured by this company are covered by patents and, we believe, have never been the subject of any litigation or legal controversy. As they embody several new and important features, a description of them preceded by a brief reference to the principles underlying

FIG. 1.—RESISTANCE COIL AND SUPPORT USED IN GOLD'S IMPROVED ELECTRIC HEATER.

their construction will be of interest. The efficiency of an electric heater depends very largely upon the access which the flow of air has over the heated wires. The principle of a free circulation of air through the heater, so that all of the electrical energy developed into heat is utilized to the best advantage by being carried off of the resistance wire and into the car body in an even and steady flow of warmed air has been demonstrated to be the most satisfactory and proven itself the means of warming the cars at the least expense of current.

The object, therefore, has always been to so arrange the construction of these electric heaters that the freest possible circu-

FIG. 2.—FRONT VIEW OF GOLD'S IMPROVED THREE-DEGREE PANEL ELECTRIC HEATER.

lation of air may be had, so that the air as it passes through the heater should be divided into the smallest particles, and each particle of air come in contact with the heated surface, and as a result, carry with it into the car body its full and equal share of the heat generated. It is now and always has been the constant aim of the company to get the benefit in the form of thoroughly warmed air in the car body of all of the electrical current expended in the heater, and the only known practical way of accomplishing this is by having a free circulation of air through the resistance coils.

The construction of the improved Gold heater provides for the features desired. The resistance coils are supported in such

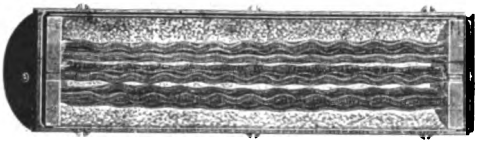


FIG. 3.—INTERIOR VIEW OF GOLD'S IMPROVED THREE-DEGREE PANEL ELECTRIC HEATER.

a way that the support itself, while holding the wire firmly in place and not permitting vibration, will offer the smallest possible amount of friction to the flow of air through the heater. This new method is shown in Fig. 1, and as can be readily seen from the illustration, this method of supporting the resistance coil of an electric heater is quite novel and is radically different from anything of a like character that has ever been attempted. It is compact, efficient, simple and durable.

This support consists of a one-quarter inch steel rod, which is thoroughly covered with an insulating enamel and which enamel is burned on the rod at over two thousand degrees of heat. It is, therefore, not affected by any heat to which it will ever be subjected, and is at the same time an absolute non-conductor. This rod is shaped in a zig-zag form, and the re-resistance with absolute non-corrosive qualities. This wire is shown by the illustration in Fig. 1. Special attention has been

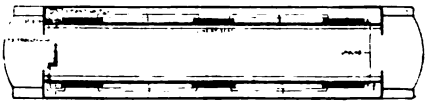


FIG. 4.—PLAN OF CAR EQUIPPED WITH GOLD HEATER SHOWN IN FIGS. 2 AND 3.

given to the composition of the resistance wire used in these coils, and in that which is now produced is combined a high resistance with absolute non-corrosive qualities. This wire is the company's own product and it is the result of long and careful experimenting.

It has been tried under all sorts of conditions and has never been known to fail. The result shown by this wire has made a very great demand for it, as it has earned the complete approval of every one who has used it.

The resistance coil is wound on an open pitch, so that when it is placed on the zig-zag rod the wire is in its natural condi-

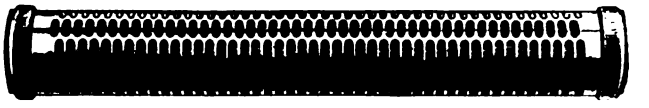


FIG. 5.—GOLD STANDARD ELECTRIC HEATER.

tion and is not subjected to any strain whatever. It has only tension enough to keep it firmly in place. The many advantages of this method of construction are apparent.. A large amount of wire is secured in a small space without resorting to the use of a bulky and solid core. This construction is certainly the acme of simplicity. There is no bulky core to obstruct the passage of the air, but, on the contrary, the very freest circulation of air through the coil takes place, and it is a known fact that to thoroughly heat air it must be circulated, or, in other words, must be divided up into the smallest particles and passed over the heated surfaces.

The wire is evenly heated over the entire surface and always maintains its original and natural condition. In the improbable event of a wire breaking it would be held fast on the supporting rod, whereas, in heaters which have the wire wound around on

FIG. 6.—PLAN OF CROSS-SEAT CAR EQUIPPED WITH 12 GOLD ELECTRIC HEATERS.

a core under tension, when a wire does break it will unwind and short-circuit with the heater casing.

This improved construction is used in all of the electric heaters which are now being manufactured, and the results given by it in the many different forms of heaters are all that could be desired.

Fig. 2 shows the most improved form of electric car heater. This heater has the coils so arranged that the upper sets are heater being flush with the panel. It is the standard size of such electric heaters in use to-day. Like all of the apparatus, it is solidly built, the mechanical details are all perfect and it is very easily applied. Fig. 3 shows the interior. It is lined with asbestos and has an air space provided at the top as shown. This heater has the coils so arranged that the upper sets are in multiple and the lower set in single series. It is usual to apply six of these heaters to a car of about twenty-four foot body and graduate the heat into three different degrees by turning the handle of the switch to any of the three points noted on the dial.

A specially constructed switch is used with which the first or lowest degree, the second or medium degree, or the third and hottest degree may be had by turning the handle of the

Digitized by Google

switch to points 1, 2 or 3, noted on the dial, for such degree of heat as may be desired.

Fig. 4 shows a plan of a car equipped with six Gold heaters, having the three degrees on each heater. When the regulating switch is turned to the first point the current passes through the lower set of coils of every heater; at point number two the lower set of coils is cut out and the current passes through the upper sets in every heater in parallel series, and at point number three the current passes in multiple series through all the coils of every heater in the car, and, as a consequence, all of the heaters distribute the warmed air at an even temperature at all times, no matter at which point the switch may be set, thus maintaining in the simplest possible manner a perfect regulation of temperature which is even, agreeable and uniform in all parts of the car.

The regulating switches, as well as all other parts used in these electric heating equipments are as simple as it is possible to make them, and their durability is guaranteed. All of the material used for the appliances is of the best quality to be obtained in the market, the workmanship is first class in every respect and a great deal of mechanical skill and ability is embodied in the heaters which are now being produced. The company carry in stock a great many different styles and designs of electric heaters.

With reference to the principle of complete circulation of air through the resistance coil, it can be plainly seen that heaters having the resistance wires imbedded in asbestos or other such material cannot be as efficient or as durable as a heater in which this improved construction is used.

Fig. 5 shows a view of the Gold Standard Electric Heater. This heater consists of three Gold improved resistance coils and supports shown in Fig. 1, in series. These rest in porcelain plugs or caps at either end and are encased in a cylindrical perforated sheet-iron casing, as shown. This heater is 3 inches in diameter and about 20 inches long. It has been greatly admired for its simple construction and surprising efficiency. It is particularly adapted for cross-seat cars, elevated railway or regular railroad cars which are propelled by electricity.

Fig. 6 shows a plan of cross-seat street car equipped with twelve Gold standard electric heaters, controlled by a two-point regulating switch.

A great advantage of this Gold standard heater is that, being of such compact form, it is a very desirable size and style with railroads, as it can be used in so many different positions.

Perfect uniformity of distribution of the heat can always be secured from this style of heater, for they can be placed about the car in such a way that this condition can always be maintained. They are very light in weight and their durability is guaranteed. These Gold standard heaters can be wired for two graduations on each heater.

Besides manufacturing the car heaters described above, the company have constructed a number of electric heaters of different styles and sizes for dwellings, office buildings, etc. Portable heaters of high efficiency and neat design is also one of their specialty and have won universal favor.

Cleveland Electric Co., Cleveland, Ohio.

THIS company, well known in the electrical field as manufacturers of electrical appliances have directed their chief energies to the manufacture of two specialties, one known as an automatic time switch (Fig. 1), the other a high tension arc cut-outs (Figs. 2 and 3). The former are made in various sizes up to 200 ampere capacity and are designed for use in automatically closing or opening electric light or power circuits. The device as shown in Fig. 1 consists of an eight-day clock movement, but without hands, placed in the middle of a metal case, a two or three pole, double brake knife-blade switch placed below the clock, with an electromagnet in a circular case, above which actuates a lever that passes behind the clock and connects with the movable parts of the switch. The action of the switch is adjusted by means of two discs or dials, one being larger than the other, and both mounted on the hour stem of the clock movement, being held in position by means of a thumb screw. Each of the discs is divided into sections representing the hours of a day, and each has a notch in its periphery, at the zero point, into which a contact arm drops when the time for switching arrives, that on the small disc closing the circuit and the one on the large disc opening it, so that by properly adjusting the discs, the switch will act at any pre-determined time. The current that energizes the magnet is cut out as soon as the switch acts so that the flow of the current through the magnet coils is only for a moment, and thus avoids any injury to the magnets from any excessive

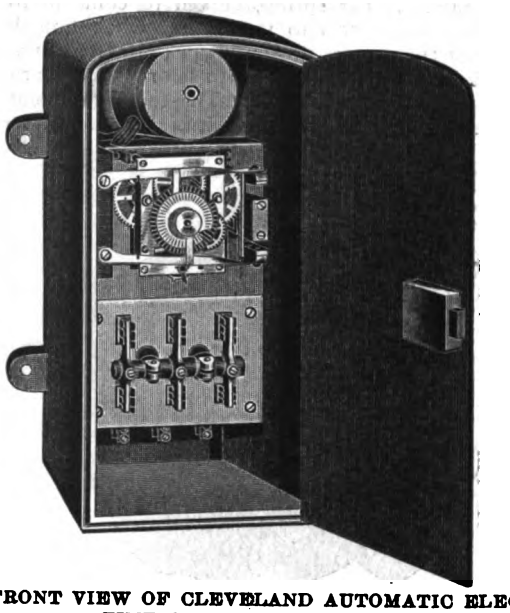


FIG. 1.—FRONT VIEW OF CLEVELAND AUTOMATIC ELECTRIC TIME SWITCH, IN CASE.

flow of current. The armature, which operates the switch lever, is thrown back and forth by means of two coils, which are placed in either end of the circular case, the armature terminating at each end in a large washer and the direction of the movement depends upon which of these coils receives the current. The disc being set, the action of the switch will occur at the same hour every day with no further attention, except to wind the clock once a week. The switch does not interfere, however, with the regular cutting in or out switch, which may be operated at any time as before. It will be seen that the use of the switch will work a saving to any consumer who uses current on a meter basis, and it is likewise of advantage to the

FIG. 2.—CLEVELAND ARC CUT-OUT, WITH COVER ON.

producer, as it saves time consumed in switching, besides there is a gain in having light switched on or off at the same time. The clock mechanism is of German manufacture, and the whole is enclosed in a neat metal case having a door and lock.

The arc cut-out provides for readily cutting in or out one or more lights on high tension arc circuits. The switching mechanism is enclosed in a circular iron case, with a close fit-

Digitized by Google

ting waterproof cover, which is about ten inches in diameter. The levers are mounted on a porcelain base within the case with porcelain thimbles in the side of the case for receiving the line connections. The handle is of hard wood and the connecting bar between the handle and contact arms is made from fibre insulation. A flat spring, curved to conform to the exterior of the case, serves to throw the switch quickly, as the handle passes the centre, preventing a protracted arc.

The works are located on the fifth floor of the Marine Building, 14 Middle street, Cleveland. The tool equipment consists of iron working and stamping machines of such number and de-

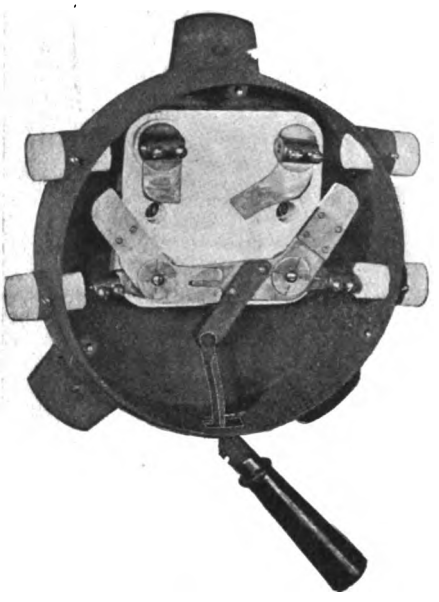


FIG. 3.—CLEVELAND ARC CUT-OUT, COVER REMOVED.

sign as to meet all the requirements for building the various parts with the exception of the clock mechanism which, as before stated, is of German manufacture. Auxiliary to the tool equipment is a generator which supplies current for lighting the shops and also for testing the appliances, it being the practice to submit each device to a thorough current test before shipping.

The affairs of the company are under the management of Mr. Frank Rogers, who is also superintendent of the works. Mr. Rogers has long been at work in the electrical field, having been in the employ of the Brush Electric Co. for many years.

Westinghouse Dynamos and Engines for Europe.

THE Westinghouse Machine Co. and the Westinghouse Electric and Manufacturing Co., on the afternoon of Saturday, July 30, invited a large number of prominent engineers to their works at East Pittsburg, primarily to inspect some five new engines and electric apparatus which are about to be shipped to England. The visitors saw three 2,500-horse-power electrical generators, direct connected to three 2,500-horse-power engines, which were constructed for the Metropolitan Electric Supply Co., of London. Their present contract with the Westinghouse interests calls for three compound two-phase steam alternators, each consisting of an enclosed vertical compound engine with the armature of the generator coupled direct to the engine crank shaft, the engine and generator being mounted on separate bed plates.

The engines and generators are so designed that the full output can be obtained at any speed from 116 to 145 revolutions per minute, this range of speed being necessary in order to provide a variation in the frequency of the alternations, and thus enabling a supply to be given to existing transformers in London.

The engines are of the enclosed vertical compound marine type, long since popularized by the Westinghouse companies, and they are the most powerful engines yet made at East Pittsburg.

The electrical apparatus built by the Westinghouse Electric and Manufacturing Co., accompanying these engines, consists of three direct connected alternating current generators, each having a nominal output of 2,000 horse power and delivering two-phase currents at a pressure of 500 volts. The armature, or the revolving element, of each generator, as before mentioned, is mounted directly on the engine shaft.

There is one direct current multipolar exciter to each generator, which is arranged for direct connection to the engine shaft.

This plant is to supply primarily arc and incandescent lighting to London, but a portion of the power is to be used for operating rotary transformers, which in turn supply current to direct current motors, and for charging storage batteries by the three-wire D. C. system.

Apart from the machines contracted for by the Metropolitan Electric Supply Company, the gas engines and the steam turbines at the Westinghouse Machine Co.'s works are particularly noteworthy. The Gas Engine Department is doing a large business, turning out engines from 10 to 200 brake horse power and shipping them all over the country. The principle on which they run is a modification of the well-known Beau de Rochas cycle. This consists of compressing the charge into the head of the cylinder before igniting it. These engines differ from the ordinary type in that the governor acts by controlling the quantity of explosive mixture which is taken into the cylinder. This results in an adjustment of the power of each explosion to the amount of work being done; hence the engine runs with the steadiness and regularity of a first-class steam engine. The regulation is so perfect that the company has built many direct connected rigs where the dynamo is mounted rigidly on the end of the engine shaft. Even under this most severe test the lights are perfectly steady.

The Westinghouse Machine Co. have also been reaching forward and have successfully built a 650 brake horse power gas engine. This engine has three cylinders, each 25 inches in diameter, and a 30-inch stroke, and runs at 145 revolutions per minute. Its economy is very marked, resulting in the production of a brake horse power for 11 cubic feet of natural gas. This is the largest gas engine in the world, and it operates with complete success.

A Parsons' steam turbine driving a 200 horse-power alternating current generator was particularly interesting to the visitors.

The turbine on exhibition runs at 4,700 revolutions per minute without any perceptible vibration. This speed, however, is not limited in any way. It may be either higher or lower. The bearings, which are a special feature, admit of any rotative speed that might be desired.

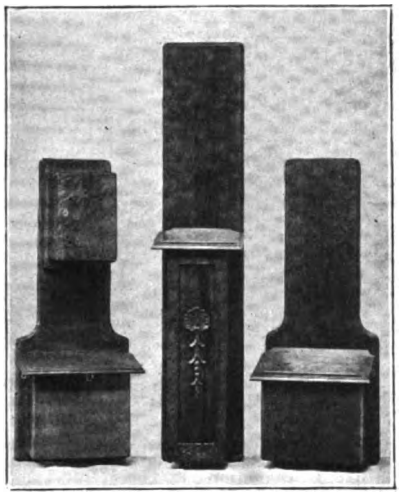
The Cabinet Mfg. Co. of Steubenville, O.

CABINETS and cases for housing electrical appliances, constitute the principal output of the works of this company, and, of these, telephone cases of every description predominate. The product, however, is not confined entirely to this class of goods, but embraces, according to the demand, fancy cases of every description, such as jewelry boxes, cases for travelers' toilet sets and medicine cases. The company enjoys exceptional facilities for filling all orders, for high grade goods, and among these facilities may be noted, the locality. The region produces, in abundance, a fine quality of oak and black walnut timber, which is the chief material employed, and which is purchased first hand from the farmers, who deliver it with their own teams directly to the storage yards of the company. Again, the employés are of a higher order of intelligence and possessed of a degree of mechanical skill above the usual run of mechanics; and third, the factory equipment embraces the latest up-to-date wood working and finishing machines that are to be had. The factory building, which is a four-story brick structure, is located near the business centre of the city and extends across the block from Fourth to Fifth streets. The lumber yard adjoins, and the course of the material is first to the re-sawing department, which is located in the basement and where by band and cross cut saws it is cut into proper thickness and length for the drying kilns. Power for operating the saws is furnished by a 100 h. p. engine, while there are two other engines driving other machinery and the fans at the drying kilns. Steam is generated in a 130 h. p. battery of tubular boilers, the fuel consisting of shavings and coal, the former being delivered to the fire room by means of a system of exhaust pipes, which take up all the shavings

Digitized by Google

and dust from each machine and deliver it through a separating head into the fire room. The shafting for driving the tools of each department is located under the floors and is so provided with clutches that the machines of any department may be started or cut out independent of those on the other floor.

The drying kilns, of which there are five, and which have a capacity each for 14,000 or 15,000 feet of lumber, occupy a separate building 100 x 18 feet and are constructed on what is known as the "common sense" plan. Each room is provided with a nest of one-inch steam pipes, which are placed beneath the floor and there are flues in the ceiling, through which the moist air is drawn by means of a fan, when it is directed into a case containing a coil of cold water pipes upon which the moisture condenses, and from which the dry air is again returned to the kiln. In the process of seasoning, the room is first filled with live steam under pressure, which is designed to drive the sap out of the pores of the wood. This is followed by the heat which is increased by stages until quite a high temperature is reached, exhaust steam being employed during the day and live steam from the boilers at night. The period for seasoning is about fifteen days, so that the kilns are each replenished twice a month. The material is now taken to the second floor of the main building by an elevator and is here



TELEPHONE CABINETS MANUFACTURED BY THE CABINET MFG. CO., STEUBENVILLE, OHIO.

planed and sawn into varying dimensions suitable to each part of the case, and the different parts are numbered so that they accompany each other in groups through all the departments to the assembling rooms. On the next floor the material is introduced to the machines known as jointers, tickers and moulders, and here the fitting is continued; one of the most interesting machines being a "locked corner cutter," on which miniature tenons and mortises are cut in the ends of such pieces as are designed for box sides, so that most of the work is put together by mechanical fits and held in place by glue without the use of brads or screws. There are numerous sandpapering machines on which the parts are carefully smoothed up, except such mouldings as require hand work. Here is also a round cornering machine by means of which the corners are rounded off after parts have been glued together.

The assembling and gluing department occupy part of the third floor and here the process of shaping begins and numerous clamps and racks are provided for holding the parts together till the glue has set. In this department is an ingenious squaring machine or press having adjustable arms which, on being closed by a hand lever, bring all the box shapes to perfectly square angles without the process of measuring and hand adjustment. The half finished parts pass back and forth between the gluing and fitting departments till all the odd shaped pieces are added, when the cases are advanced to the varnishing and finishing department which occupies the top floor, and for which work female help is chiefly employed. Here coat after coat of filling material is applied and rubbed down with oil and pulverized pumice stone, when the coats of varnish follow with repeated rubbing until the grain is thoroughly brought out and the surface shines like a mirror. Cases are now ready for final inspection and go to the shipping department, where they are carefully wrapped in paper and crated for shipment. The company not only manufacture cases from their own designs, but give special attention to exclusive designs furnished by customers. The executive offices occupy the first floor on the street side of the building, and the affairs of the company are under the management of Mr. M. T. James.

The National Electric Co.

THE name, electric, generally conveys the idea of a manufacturer of electric machinery or appliances, for the generating or control of electric energy, but in this case it represents an industry that is closely allied to manufacture, except it is mending instead of making and is one to which all users of electric machines must sooner or later resort. It is well understood that the reconstruction and repairing of electric machinery requires as much care for perfect workmanship and durability and involves as much genius usually as is displayed in designing and constructing original machines. As the work furnishes practical experience, it goes without saying that one engaged for eighteen years, as in the case of the manager of this company, in the building and repair of electric machinery, will be able to do the work right and with a stronger guarantee of success than can be furnished by mechanics inexperienced in this line of work. This fact the users of electricity are coming to see, and many companies that were formerly doing their own repairs are finding that it is profitable to have it done by professionals, even with the freight charges added, so that this company enjoys a patronage from nearly all parts of the country.

"General electrical repairs" is the term used to designate the work, and the line includes rewinding and repairing armatures of every type and size, especially the armatures from large machines. It also includes the making and repairing of commutators, transformers, and the making of duplicate parts, including the armatures of any electrical machine. The works occupy a three-story brick building, 15 Michigan street, and the equipment of tools is very complete. The large tools occupy the ground floor, while the smaller tools and the store room are located on the upper floors. The tools are all operated by electric power from current obtained from the city lighting plant. Among the special appliances may be noted the process for balancing armatures after they have been rewound. This consists of a stone foundation, independent of the building floor and foundation, on which are placed sets of metal ways according to the size of the armature to be balanced and so arranged with adjusting mechanism that an absolute level may be secured, making a very important point in securing a perfect balance. On the same floor is a baking box, or oven, so arranged with end doors that the largest armature may be placed in position by means of a truck without any lifting. The company makes a specialty of rebuilding defective generators, or such as need to be redesigned to suit the demands of new lamp conditions, especially where the enclosed arc is replacing the open arc type of lamps, as where the latter require about 9½ amperes, the enclosed type requires only 6½ amperes. For this reason a change in the windings of generators becomes a necessity. The works are not wholly confined to repairs, but small motors for any purpose are built and motors and experimental machines are built for inventors and engineers. Second-hand machines are also bought and sold.

The management of the company is in the hands of Mr. J. E. Elliott, who, as said above, has had eighteen years' experience in electrical work, having begun with electrical training in the shops of the Brush Company in 1880. For this reason and also because the employees are all skilled in their various lines, the company are able to guarantee the work and assure their patrons that where durability is taken into consideration they can effect a decided saving over home-made repairs.

Ball Engine Sales.

The village of Richmond, Mich., is to have a new electric light plant. The new electrical apparatus is to be furnished by the Westinghouse Electric and Manufactring Co., and the steam plant by the Ball Engine Co., Erie, Pa.

One of the most complete isolated electric plants in Columbus, O., will be that of the Peruna Drug Mfg. Co., now being installed. Ball engines aggregating 550 horse power, direct connected to Siemens-Halske generators, furnish the power.

Digitized by Google

The W. E. Petite Enclosed Long Burning Arc Lamp.

The Western Electric Company, in placing upon the market its new long-burning arc lamp used the name "Midget" in describing it, owing to its size, the lamp being but 20 inches in length. The name "Midget," however, is no longer used by them in describing this lamp, but the name "W. E. Petite" has been adopted.

NEW YORK NOTES.

THE GUGGENHEIM SMELTING CO. are making extensive additions to their refining plant at Perth Amboy, N. J. The buildings they are putting up will be fireproof throughout, being constructed of steel framework covered with corrugated iron. The contract for furnishing and erecting these buildings has been let to the Berlin Iron Bridge Company, of East Berlin, Conn. The Berlin Iron Bridge Company have lately shipped to Mexico two large buildings for the same company.

CHANGEABLE ILLUMINATING INDICATOR CO., of New York City, has been formed. Capital, $40,000, and directors: William E. Finn, David L. Phillips, Lewis J. Philips, Geo. W. Tallman, Harturg J. Phillips.

NEW ENGLAND NOTES

G. M. ANGIER & CO., 64 Federal street, Boston, Mass., have done a shrewd thing by issuing a neat card which gives the "War Taxes," so that at a glance one can see what stamp or tax is required for any document or transaction within the provisions of the new law. The card is so printed that it can be hung up in an office.

ADVERTISERS' HINTS.

F. S. BLACKALL, of the firm of Blackall & Baldwin, 39 Cortlandt street, New York, is at present advertising for bids for the extension of the Shanghai, China, municipal plant. Mr. Blackall offers to forward to the council literature from manufacturers of electrical apparatus, tools and supplies, if they will send same in duplicate to him.

THE ELECTRIC APPLIANCE CO., 242 Madison street, Chicago, always have a full supply of glass insulators for telegraph, telephone and electric light work.

G. C. WOOLVERTON, 442-446 Niagara street, Buffalo, N. Y., has succeeded the Woolverton-Elliott Electric Co., and will continue the extensive repair business the late concern built up.

THE EDDY ELECTRIC MFG. CO., Windsor, Conn., illustrate one of their large direct-connected units. This type of generator is very fully described.

SEATON M. SCOTT, 123 Liberty street, New York, makes a specialty of the design and supervision of central stations.

WESTINGHOUSE ELECTRIC & MFG. CO. have recently been called upon to furnish three 2,500 h. p. generators to the Metropolitan Electric Supply Co., of London, Eng.

H. W. JOHNS MFG. CO. call attention to the fact that Vulcabeston products being heat-proof are particularly adapted to use in arc lamps and make a specialty of parts for that purpose.

THE COLUMBIA INCANDESCENT LAMP CO., who have adopted for their trade-mark "Unequalled in Quality," invite central station managers and others to make a most rigid test of their product with respect to those points which go to make a successful incandescent lamp.

THE AMERICAN ENGINE CO. call attention to their generators and motors, both belted and direct connected, for all purposes.

J. JONES & SON at the very outset of the fall season advertise a desk clamp which will fit any roll top desk, thus keeping an incandescent lamp in a handy position where it will radiate the most light.

THE WALKER CO. show in their advertisement an illustration of the field and armature of their alternating current generators, which are built in different phases at 40 or 60 cycles, and announce that at the present time they have in process of construction over 25,000 h. p. of this type of machinery.

GORDON BATTERY CO. is now the name of the company marketing the Gordon Primary Cell, which has many points of excellence.

ELECTRIC STORAGE BATTERY CO. present a testimonial letter from a battery user, who has found in an experience of over one year with one installation that the Chloride Accumulator is an economy in a well-regulated plant.

POWER GENERATORS are treated of in the announcement of the C & C Electric Co. for railway work as well as stationary service.

THE NEXT NEW YORK TELEPHONE DIRECTORY goes to press September 1. Intending subscribers have a little more than two weeks in which to be represented in it.

CONTENTS.

EDITORIALS: Page.

The Detroit Municipal Convention 130
German Central Station Statistics 130
Recent Progress in Electrolytic Operations 131
Protecting Well-Behaved Lighting Corporations 131
"Electric Belts" 131

ELECTRO-CHEMISTRY

Electrolytic Processes for the Extraction, Separation and Refining of Metals. The Tommasi Process (illustr.) ..... D. Tommasi. 121
The Soot of Acetylene Flames 124

ELECTRIC TRANSPORTATION:

Power Transmission and Distribution for Railway Work ..... Ernst J. Berg. 125
Charging Station for Paris Automobiles (illustr.) 126

TELEPHONY AND TELEGRAPHY:

Practical Features of Telephone Work—XIX. (illustr.) ..... A. E. Dobbs, 127
Farm Telephony in Michigan.—Independent Telephony in Maryland.—Payment of Telegraph Tax 128

LITERATURE:

"Lighting by Acetylene Gas," by Wm. E. Gibbs, M.E.—"The Telephone," by W. J. Hopkins.—"The Sunbeam Magazine."—"Facts About the South," by R. H. Edmunds 129

PERSONAL:

Mr. Hiram S. Maxim.—Mr. G. A. Loring.—Mr. Ernest Gonzenbach.—Mr. G. W. Mansfield.—Mr. John A. Brill.—Mr. W. D. Sargent.—Mr. Alfred J. Thompson 129

MUNICIPAL AFFAIRS:

Detroit Convention of the League of American Municipalities 132

ROENTGEN RAYS:

The Decreasing Demand for X-Ray Apparatus. W. J. Clarke.—A Possible X-Ray Lighting Effect 133
Polarization of Röntgen Rays.—Testing the Purity of Coal by Means of X-Rays 134

LETTERS TO THE EDITOR:

Preventing Collisions at Sea. W. J. Clarke.—Shunt Method of Motor Control ..... Frank J. Sprague. 134

SOCIETY AND CLUB NOTES:

The American Street Railway Association.—Ohio Electric Light Association.—Merchants' Association of New York 134

MISCELLANEOUS:

Magnetic Clutch for Heavy Station Work (illustr.) 135

POWER TRANSMISSION:

Concentration of Power by Electric Transmission at Taunton, Mass., Tack Works (illustr.) 135

REPORTS OF COMPANIES:

Bell Telephone Output 136

MECHANICAL:

Wrought Iron Bridge Co., Canton, Ohio (illustr.) 136

THE STOCK MARKET:

Peace and Prosperity 137

INVENTORS' RECORD:

Classified Digest of U. S. Electrical Patents Issued July 19 and July 26, 1898 138

CATALOGUES:

Western Electrical Supply Co.—Chambersburg Eng. Co.—Patterson, Gottfried & Hunter.—Metropolitan Injectors 139

TRADE NOTES AND NOVELTIES:

Gold Improved Electric Car Heating Apparatus (illustr) 140
Cleveland Electric Co., Cleveland, Ohio (illustr.) 141
Westinghouse Dynamos and Engines for Europe.—The Cabinet Mfg. Co., of Steubenville, Ohio (illustr.) 142
Ball Engine Sales.—The National Electric Co. 143
W. E. Petite Enclosed Long Burning Arc Lamps.—New York Notes.—New England Notes.—Advertisers' Hints 144

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. AUGUST 18, 1898. No. 537.

TELEPHONY AND TELEGRAPHY

The Central District and Printing Telegraph Co.—Bell Telephone Interests in Pittsburg.

BY C. B. FAIRCHILD.

THIS is an odd name for a telephone company, but it is explained by the fact that when originally incorporated, it was designed to operate the Gray automatic printing telegraph instrument, as a branch of the Western Union business. It is now a telephone company, but supplies current for operating messenger call boxes for the Western Union Telegraph Co. of

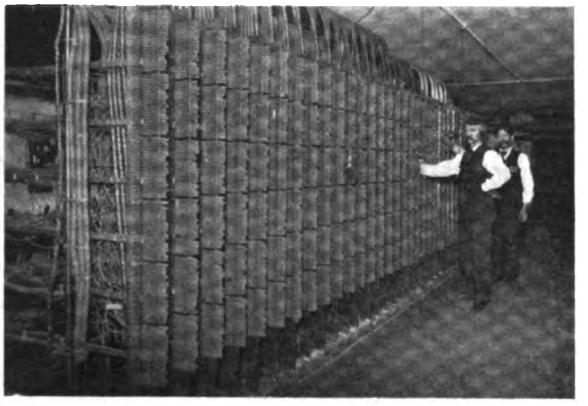


FIG. 1.—TERMINAL ROOM OF PITTSBURG TELEPHONE EXCHANGE.

this city. The territory covered by the company's franchise includes Western Pennsylvania, Eastern Ohio and West Virginia. The number of subscribers in May of this year, in the whole territory, was 19,397, of whom 7,095 are in the Pittsburg district, there being 2,923 in the Pittsburg main exchange, from which they operate 159 branches and over 700 public pay stations. Some idea of the magnitude of the business may be had from the statement that on May 10, the number of calls in the Pittsburg district was 97,042. The company occupies its own seven-story building on Seventh avenue, which was specially designed for the telephone business. The terminal room is located in the basement, illustrated in Fig. 1, and here the wires for the 4,200 lines are brought out from the cables in pairs of twenty. About 68 per cent. of the lines are metallic circuit. The main power station of the building is also located in the basement, and the equipment consists of two 50 h. p. Ball engines and two 400-lamp generators. Adjoining the engine room are a motor and seven small generators for supplying current to operate the messenger boxes, private telegraph lines and subscribers' desk telephones. A portion of the first floor and an adjoining building are used for the storage of material and for the setting up of telephones. The trouble department also occupies a room on this floor. In connection with the testing apparatus, is a small motor which supplies the current for operating the testing instruments. A fireproof cable tower extends from the basement to the top floor. This is said to be one of the best designed and most convenient cable towers to be found in any city. In this is placed a series of iron ladders, for convenience of placing the cables, and which can be used as a fire escape, should it become necessary. The telephone power room proper, illustrated in Fig. 2, is located on the top floor, and has an auxiliary storage battery equipment of six cells. There is a small generator with which the batteries are charged at night. These supply the current for the transmitters. Two other generators supply the current for the first class exchanges and other purposes.

The operating department occupies the seventh floor, which is a large, airy room, and the main switchboard extends along two sides, with an auxiliary board on the opposite side, and the manager's desk is near the middle of the room. The board accommodates sixty-two operators, and it is divided according to the requirements of the service for regular subscribers, trunk lines, pay stations, automatic local tolls and the long distance trunk lines. Some of the special features of the board include two miniature pilot lights on each panel, one white, the other red, to indicate the call, and when rung off. Some of the shutters are marked and striped in various colors, to indicate the character of the service being rendered the subscriber connected. The outgoing call panels of the toll board are provided with calculagraphs, which are placed flush with the counter, exposing the face of the clock. The record cards are inserted in a slot under the face when a call is made. The operator pulls a lever on the right and the time connection is made as indicated on a card by a printed dial. When the number is rung off, the operator pushes a lever at the left, and another dial is printed, indicating the time the communication ends. These cards also contain the number of the telephone calling and the operator's number. The average number of calls answered per hour per operator is usually about one hundred and forty, the maximum, two hundred, but when the latter number is reached the lines are re-distributed on the board. Ten trunk lines connect with the office of the long distance system on the outskirts of the city, seven miles from the central exchange. The charge for unlimited service per year is $125. A measured service is also provided, as per the subjoined schedule: Long distance residence telephones, 400 "out" calls per annum. No limit to "in" calls. Four party lines, $30, additional calls 5 cents each, or $4 per annum. Schedule of special and party lines measured service for business and residence use:

No. of calls.	1 party.	2 parties.	3 parties.	4 parties.	Extra calls.
600	$60	$50	$42	$39	7c.
700	66	56	48	45	6c.
800	71	61	53	50	5c.
900	75	65	57	54	5c.
1,000	78	68	60	57	5c.
1,100	81	71	63	60	5c.
1,200	84	74	66	63	5c.

In breaking in new operators, they spend two or three days watching one of the regular operators, and listening to the calls in answer, and when accepted, they are put on the half-day

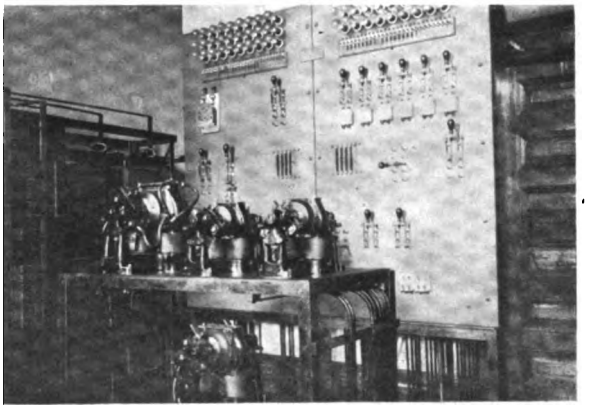


FIG. 2.—POWER ROOM OF PITTSBURG TELEPHONE EXCHANGE.

work, which begins at five and ends at ten o'clock p. m., for which they receive $15 per month. The next shift from ten to seven o'clock a. m. receive $25 per month. The regular day operators work ten hours, with forty-five minutes for lunch, and receive from $25 to $35 per month, depending upon the length of service, the maximum being reached after four years in the company's employ. The monitors and assistant chief operators receive $50 per month. The manager, Mr. S. M. Morrell, does not regard the work as being especially hard on the operators, some of whom have been at the business for fifteen years in this exchange. The list of applicants is usually 150 ahead.

Digitized by Google

The company operate about 300 sub toll stations in connection with the Pittsburg Exchange system. These stations are located at convenient points throughout the district and are extensively used by parties whose business or social requirements do not justify subscription for regular exchange service.

The toll slot machines of the Gray telephone pay station type are used for many of these stations, and the service rendered is generally very satisfactory.

The business offices of the company are conveniently located on the different floors of the building, and the number of employés and canvassers is about 275. Mr. D. Leet Wilson, president Fort Pitt National Bank, is president; Mr. D. F. Henry, formerly well known in the street railway field, is vice-president; Mr. D. Paynter is superintendent; Mr. J. G. Stoakes, secretary and auditor, and J. M. Stephenson, treasurer.

Motor Generators for the Chicago Fire Alarm System.

SOME time ago the Chicago city fire alarm under the supervision of the new city electrician, E. B. Ellicott, and assistant city electrician in immediate charge of the fire alarm system, D. M. Hyland, was improved by the substitution of storage batteries for the gravity batteries which for years had been employed for the fire alarm circuits. In connection with this change, other apparatus has been put in which is of interest.

The fire alarm system of Chicago, as in all the large cities of this country, is a closed circuit system; that is, a small amount of current is kept flowing constantly through the circuit, the alarm boxes are placed in series on the circuit, and the fire alarm signals are made by the momentary opening of the circuit by a signal street box. Absolute reliability and constancy are of course essential features of any current supply for this class of work. The storage batteries recently purchased by the department offered the feature of reliability and constitute a reserve that can be depended on as long as the building containing them stands. It is necessary, however, to provide for supplying the fire alarm circuits when the batteries are being charged, and to do this the outfit here described and illustrated has been put in. It consists of a set of motor generators adapted to be run from a 110 volt circuit. Each motor generator consists of a 110 volt motor, for direct current, directly connected through a flexible coupling to a direct current dynamo of a voltage suited to the particular fire alarm circuit it is desired to supply. The two machines are set on the same bed plate. Fig. 1 shows the connections of a motor generator and fire alarm circuit, while Fig. 2 shows the set of motor generators installed for the Chicago fire alarm system. The motor is shunt wound, as is also the generator, so that the fields of both machines are connected directly across the mains of the 110 volt supply circuit. The speed of the motor is varied by an adjustable resistance in its field circuit. The field circuit of the generator is also provided with a variable resistance. From the armature of the generator, to which the fire alarm circuit is connected, the circuit runs out through the various street alarm boxes and back through a relay in the central office to the motor generator. The office apparatus which the relay operates does not now concern us. The double throw switch is for throwing the fire alarm circuit either on the motor generator or on the storage batteries. The duty of the motor generator when in use is to maintain on an alarm circuit a current of .04 ampere. The current in the fire alarm circuit can evidently be adjusted in a number of ways by the arrangement of apparatus shown. The current around the fields of the generator can be varied, the speed of the motor can be changed by varying the motor field resistance, or finally an adjustable resistance in the fire alarm circuit itself can be used to regulate the amount of current flowing in the fire alarm circuit.

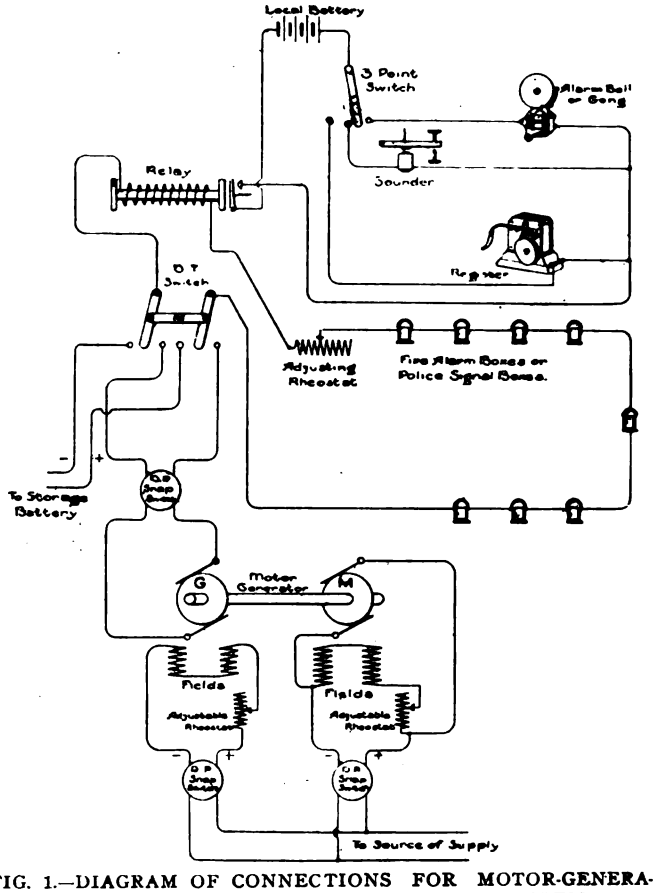


FIG. 1.—DIAGRAM OF CONNECTIONS FOR MOTOR-GENERATOR PLANT OF CHICAGO FIRE ALARM SYSTEM.

Six motor generators have been put in. One of these gives 100 volts for the alarm circuit, two give 70 volts, and three give 40 volts. Thus six different circuits are supplied. The motor generators were supplied by the Western Electric Company. They have been in continuous operation since they were put in, and, except when the storage battery is being "exercised," will probably be used most of the time.

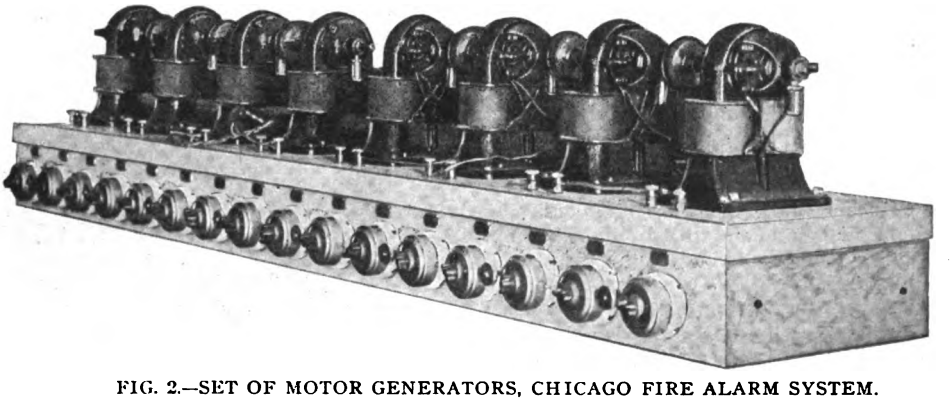
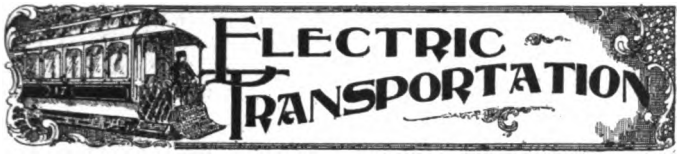


FIG. 2.—SET OF MOTOR GENERATORS, CHICAGO FIRE ALARM SYSTEM.

NEW CABLE STEAMER. The largest cable steamer afloat has just been launched in England for the Telegraph Construction and Maintenance Co., Ltd. She is 465 feet long over all, and has four huge cable tanks. She is called the "Anglia."

Digitized by Google



The "American" Electric Motor Vehicles.

IN view of the rapid strides which have been made in the development of automobiles in this country and the interest which is being manifested in the art by inventors, scientists and the public in general, it would appear as if we were on the eve of a great industrial revolution along the lines of road transportation. Each week brings forth new developments, more efficient motors and simpler mechanisms; and the existing competition along this promising line must certainly be productive of splendid results. Regarding the motive power it appears as if electricity, the most subtile, adaptable and elastic force known to engineers, will beyond a doubt triumph as the ideal agent for carriage propulsion.

We are pleased to note the energy with which companies are pushing to the front vehicles using electricity for a motive power and the success with which they are meeting. One of the first companies to begin the manufacture of electrically propelled vehicles are the Indiana Bicycle Company, of Indianapolis, Ind., who are now putting on the market their splendid line of American electric motor vehicles, a number of which are illustrated herewith. They are the outcome of experimental

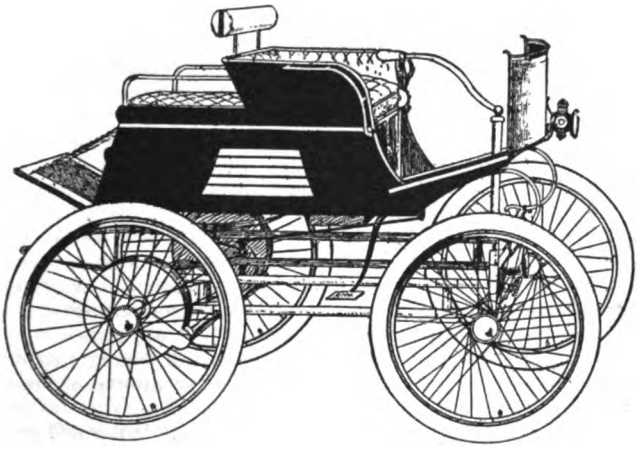


FIG. 1.—RUN-ABOUT, 1½ H. P.

work conducted at a cost of more than $150,000, which has resulted in the production of a simple, comparatively light and most practical machine for pleasure or business, a machine of high efficiency, economically and easily operated and entirely free from objectionable features.

The carriages are constructed throughout in the most thorough manner from carefully selected materials, and are designed to withstand continuous hard service under the most trying conditions. The frame work of the running gear is tubular, with large, strong connections carefully brazed at each joint, the whole designed to resist all strains likely to be put upon it. The tubing is cold-drawn and seamless, of highest grade manufactured. All wheels have ball bearings, those for the lighter types of carriages being wire spoked and having Royal single tube pneumatic tires, the heavier vehicles having wood spokes and cushion tires. The running gears are made in three sizes, with the slight variation in design necessary to adapt them to the variety of vehicles.

The motor is of the multipolar type, brought to the latest and most efficient practice and carefully designed for its special purpose, with due regard for overloads and having a reserve capacity sufficiently large to insure it against accidents. It is rigidly hung to the frame of the running gear and it and all gears are carefully covered, amply protecting them from dust and water so that in cleaning the carriage only moderate care need be exercised.

The motor shaft is geared directly to the two rear wheels, propelling the vehicle by a single reduction. Each rear wheel is made to revolve independently of the other by compensating gears placed in line with the motor shaft. Motors are made in three sizes of one and one-half, two and one-half and three

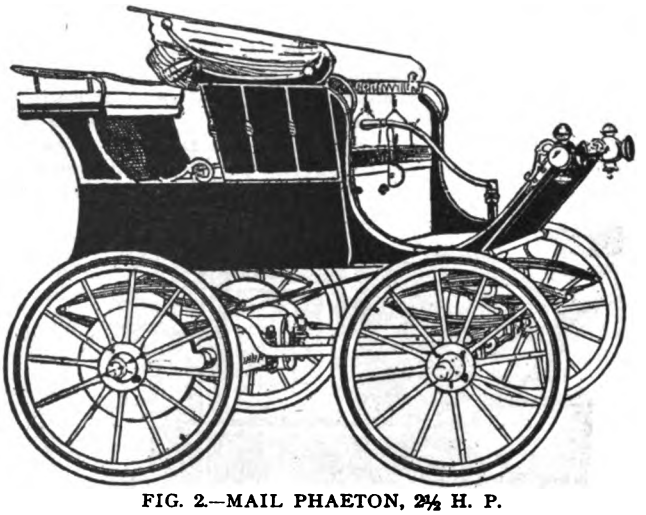


FIG. 2.—MAIL PHAETON, 2½ H. P.

and one-half horse power each, according to the weights of the vehicles.

The batteries, said to be covered by broad and original patent claims, are of a new and distinct type, and are claimed to be of less than one-half the weight of the usual storage cells used in other wagons of the same capacity. The battery consists of forty-four polarization cells varying in size from 60 ampere hour to 125 ampere hour capacity according to power desired, the weight of the lightest being about nine pounds for each cell. These are placed in four trays of eleven cells each. The normal discharge rate of the battery is about fifteen amperes, at which rate of discharge the wagon runs at a speed of from twelve to fourteen miles per hour. A wattmeter attached to the battery is conveniently placed for observation. This meter registers the amount of power in watt hours going out of the battery and into the motor, enabling the operator to see at any time at a glance the amount of energy in store.

The charging can be accomplished by connection with any direct current lighting circuit. An automatic device closes the switch when the batteries are full. Where a number of electric vehicles are used, like delivery wagons, etc., a small private generating plant is desirable and the company will soon be prepared to furnish such an equipment at moderate cost.

A simple ratchet lever set on notches for starting the vehicle, regulating its speed, etc., is placed at the extreme left side of the

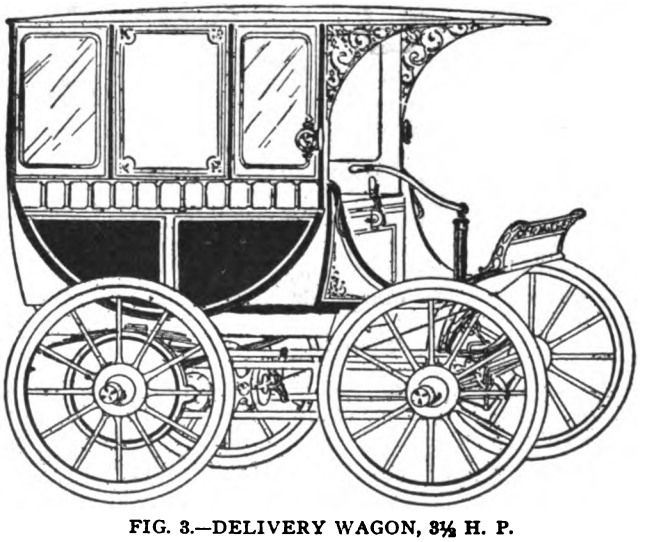


FIG. 3.—DELIVERY WAGON, 3½ H. P.

seat and actuates a controller placed beneath the seat, controlling the amount of electricity flowing from the batteries to the motor. The first or slowest speed is obtained by grouping the

Digitized by Google

four trays in parallel; the second or medium speed by grouping two trays in parallel and two in series; the third or highest speed by four trays in series. The current delivered to the motor for each of the speeds is practically constant, but the speed of the motor and the current delivered from each tray of batteries vary directly with the voltage, thus making the consumption of energy at all times proportional to the speed. The controller contacts are sliding and self-cleaning and so constructed that destructive arcing or burning at these points when shifting the speed circuits is entirely prevented. The carriage is reversed by a key placed directly below the controller, the turning of which simply reverses the polarity of the armature.

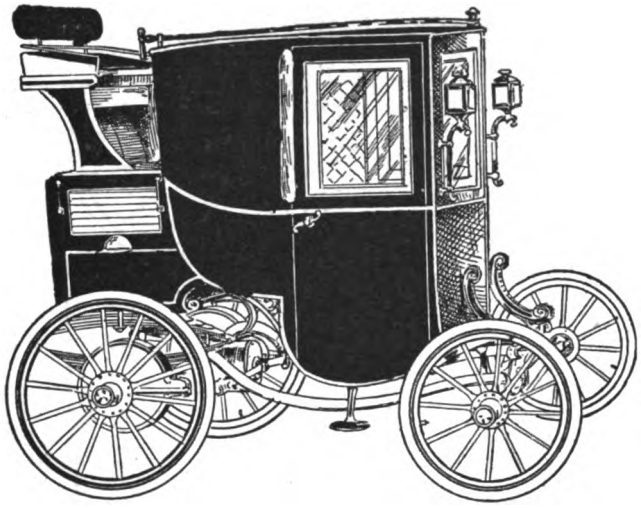


FIG. 4.—BROUGHAM, 3½ H. P.

The removal of this key makes the vehicle inoperative so that it can be safely left alone anywhere without danger from willful or accidental tampering through curiosity or malice.

The steering is accomplished by a lever conveniently placed and is a very natural movement requiring practically no exertion and needing no particular explanation. The radius of turning is done with a very small amplitude of lever movement and the small wagons can be turned completely in an alley-way fifteen feet wide. A band brake is applied to the periphery of the compensating gear drum and is operated by a pressure of the foot upon a stem projecting through the floor of the vehicle. This brake is very powerful and will stop a vehicle in about its own length at full speed, or reduce its speed gently if applied gradually.

The carriage bodies are made from the best seasoned stock, thoroughly put together, and braced and ironed in the most approved manner. They are of modern design and extremely graceful in appearance. They are furnished to correspond with the highest type of vehicles in use and careful attention is bestowed upon the elegance and comfort of the upholstering, lighting and fitting generally. In its every appointment, the "American" will favorably compare with any high class equipage for park or business use.

In Fig. 1 is shown the "runabout" of 1½ h. p. capacity, costing $1,000. A "mail phaeton" is shown in Fig. 2, its motor developing 2½ h. p. and costing $1,500. In Fig. 3 is shown o delivery wagon, of 3½ h. p. and costing $1,800. It may be of interest to present a table showing the comparative first cost and cost of maintenance of this vehicle and an ordinary delivery wagon drawn by a horse:

First cost horse power delivery wagon	$250
Two horses	250
Harness	75
Stabling, feeding, shoeing, veterinary service, etc., two horses at $25 per month for three years	1,800
Wages of extra boy with driver, at $25 per month	900
Total	$3,275
Electric vehicle, first cost	$1,800
30 miles per day for three years, or 27,000 miles at 1 cent per mile	270
Total	$2,070

Assuming that repairs will be about equal, this shows a large saving in favor of the electric vehicle. As to the above estimate, attention should be called to the fact that the wages of the driver are omitted in both cases as it is an expense common to both wagons.

In Fig. 4 is shown the "Waverly Brougham" of 3½ h. p., equipped with 44 cells of 120 ampere-hour capacity and costing $2,500. This vehicle is small and light, and is suitable for either business or pleasure. It is a stylish carriage with removable rear seat, and is designed for equipment with electric heater, if desired. The company are prepared to accept special orders and submit designs for approval and their guarantee, which has become of great value on account of the reliability of the company's products for many years, accompanies every vehicle they manufacture.

A Plea for the Introduction of Goods Traffic on Our Suburban Trolleys.

BY W. T. BONNER, MONTREAL.

THE first consideration in exploiting any new suburban tramway is the possible or available passenger traffic. That being found inadequate to guarantee a fair return on the cost of installation and maintenance, the project is usually abandoned for the reason that only passenger traffic can be considered, owing to the high cost of handling goods traffic at the terminals. While a motorman and conductor are sufficient to handle a two or three-car electric train for passenger traffic, with very little expenditure of time or assistance for loading and unloading, all railways under present systems require a large additional force to conduct the hundreds of details attending the reception, checking, loading, transferring, unloading and proper delivery, in good order, of either car lot or package freight.

It is not the railway investors alone who suffer the effects of this handicap, but the property owners also, since the latter have no recourse, while the capitalist has but to seek other more profitable fields for investment.

It may therefore be conceded that the whole subject presents two phases of commercial economy. viz.:

(a) From the standpoint of the agriculturalist and land owner; how best to provide a means for increasing the value of remote but otherwise valuable agricultural lands, and at the same time retain present value of adjacent property by converting it from market gardens into residence and manufacturing sites.

(b) From the standpoint of the capitalist and manager of railway properties; how best to increase the earning capacity of existing or proposed suburban lines.

With the ever increasing centralization of population and commerce, inaccessible property becomes less valuable; all land,

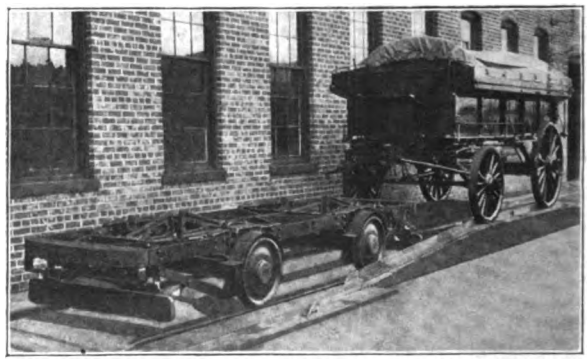


FIG. 1.

whether barren or fertile, suffering alike, according to its distance from the centre of demand for farm products, which we call markets. Such distance is not always measured in actual miles, but rather in accessibility, since in our day we find frequent examples of the paradoxical long and short haul rates. The Minnesota and Manitoba farmers will deliver their wheat at the seaboard at a lower cost per bushel than the farmer who may live a hundred miles off the coast. The Eastern farmer may have just as fertile land as his Western competitor, but he is handicapped by having to haul his wheat forty or fifty miles over poor wagon roads to reach the nearest railroad.

In either case, the terminal charges, including the cost of load-

Digitized by Google

ing the produce at the farm, is approximately the same, but the difference in cost of haulage per ton-mile by railroad and wagon road is so tremendously in favor of the former that without such facilities the farmer may as well retire from business. It has been stated as a fact that to transport a ton of coal from Buffalo to Chicago costs no more than to move the same quantity of coal across the sidewalk in either city.

In a late number of the "Marine Review" some interesting comparisons were made between the present cost of shipping coal to the Northwest and prices which obtained previous to

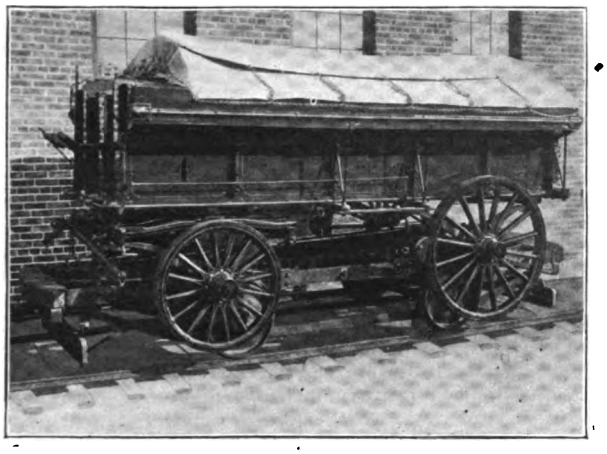


FIG. 2.

the introduction of modern vessels and automatic coal handling machinery. Car-dump machines can now load four thousand tons in ten hours, as compared with two or three days under old methods; and coal is now carried from Lake Erie ports to the head of Lake Superior at twenty cents per ton, as against fifty cents, which was considered a ruinously low rate a few years ago.

It is frequently asserted that since the introduction and development of steam railways, they have gradually superseded the earlier methods of transportation and traffic, and as a consequence highways are no longer an indication of progress. This is true only to a limited extent. Railroads have changed the character of suburban traffic, and personal travel is no longer dependent upon the condition of the highways, but commercial intercourse, as represented in the exchange of products, is as much dependent upon the condition of the public road to-day as it ever was, for the reason that it is impossible to construct a railroad to the door of each producer and consumer. Hence railroads can never entirely supersede the common road, and every ton of freight carried by them must be conveyed over a highway at either or both terminals, and the cost of this highway transportation has a marked influence, not alone upon the price paid by the consumer, but also on the profit realized by the producer.

Few people have any knowledge of the real cost of transportation by horse and wagon, or comprehend the amount of money expended needlessly every year through failure to provide proper roadways and modern tramways.

The following table shows the results of actual observations on the cost of moving a load of one ton a distance of one mile on level roadways, with different pavements and under average conditions:

TABLE I.

COST OF TRANSPORTATION BY HORSES AND WAGONS PER TON-MILE ON DIFFERENT SURFACES.

	Cents per ton-mile.
Iron rails	1.28
Asphalt	2.70
Stone, paving, dry and in good order	5.33
Stone, paving, ordinary condition	12.00
Stone, paving, covered with mud	21.30
Broken stone, dry and in good order	8.00
Broken stone, moist and in good order	10.30
Broken stone, ordinary condition	11.90
Broken stone, covered with mud	14.30
Broken stone, ruts and mud	26.00
Earth, dry and hard	18.00
Earth, ruts and mud	39.00
Gravel, loose	51.60
Gravel, compacted	12.80
Plank, good condition	8.80
Sand, wet	32.60
Sand, dry	64.00

The comparative cost of transportation over rough roads may be estimated from Table No. 2, which shows with sufficient exactness for most practical purposes, the force required to draw loaded wagons over inclines. This table shows the force exerted by the load in its downward tendency, as well as the force required to draw it up grades of various inclinations; also maximum duty performed by an average horse, weighing, say twelve hundred pounds, the friction of the surface being taken at one-fiftieth of the load drawn:

TABLE II.

Rate of grade, ft. per 100 ft.	Pressure on the plane in lbs. per ton.	Tendency down the plane in lbs. per ton.	Power in lbs. required to haul one ton up the plane.	Equiv. length of level road, miles.	Max. load in lbs. which a horse can haul.
0.0	2240	.00	45.00	1.000	6270
0.25	2240	5.60	50.60	1.121	5376
0.50	2240	11.20	56.20	1.242	4973
0.75	2240	16.80	61.80	1.373	4490
1.	2240	22.40	67.40	1.500	4145
1.25	2240	28.00	73.00	1.622	3830
1.50	2240	33.60	78.60	1.746	3584
1.75	2240	39.20	84.20	1.871	3290
2.	2240	45.00	90.00	2.000	3114
2.25	2240	50.40	95.40	2.120	2935
2.50	2240	56.00	101.00	2.244	2725
2.75	2240	61.33	106.33	2.363	2620
3	2239	67.20	112.20	2.484	2486
4	2238	89.20	134.20	2.982	2083
5	2237	112.00	157.00	3.444	1800
6	2233	134.40	179.40	3.986	1568
7	2232	156.80	201.80	4.844	1367
8	2232	179.20	224.20	4.982	1235
9	2231	201.60	246.60	5.480	1125
10	2229	224.00	269.00	5.977	1030

From the foregoing tables, and from statistics gathered by both State and national bureaus, it has been calculated that the average cost of transportation by animal power is twenty-five cents per ton per mile. Furthermore, the rate of transportation by animal power is, and always has been, excessively high, and

FIG. 3.

the evidence of all statistics, both ancient and modern, shows but slight improvement as compared with the progress made in other departments of industry, and by other means of transportation. It being true that the value of land and wages of labor are affected by the cost of transportation, we should expect to find that where so high a rate as twenty-five cents per ton-mile prevails, the land would diminish in value, and the rewards of labor bestowed upon such lands would grow less and less. What we expect to find, we do find.

A forcible illustration of this fact was brought to the writer's attention a few days ago. A resident of Long Island, living

Digitized by Google

about fifty miles out from New York City, owns 500 acres of as fertile land as may be found anywhere. Although beautifully situated, and with every natural advantage to favor production, the cultivation of all staple products has been abandoned by him owing to lack of proper transportation facilities. With potatoes jobbing at eighty cents to one dollar per bushel in New York, he was compelled to sacrifice his entire crop, giving away hundreds of bushels, rather than allow them to rot in his cellars.

It is not necessary for the careful observer to rely solely upon official reports for information, for the above is but an every-day example of the result of excessive cost of transportation, the ever-decreasing price of inaccessible land, and the diminished rewards of labor bestowed upon it. The price of land and the value of labor decreases in almost inverse proportion to the distance over which the agricultural products must be transported by horse power.

One fact is patent to all, that whereas formerly the distribution of population was approximately equal over the face of the country, it is gradually becoming concentrated into large cities to such an extent that already fully one-half of the inhabitants of the older sections of the country live in cities. The evident reason for this is competition, the demand for increased output at reduced cost. Concentration indicates increased power for production. Take, for instance, some of our commonest staples, like wheat, beef, pork, molasses, wagons, horseshoes, butter and clothing. Within the writer's memory, these articles were produced at home, or in small shops and factories distributed, like the population, quite equally throughout the country at cross-roads and villages, utilizing crude methods and operated by the old-fashioned treadmill or horse power, and overshot water

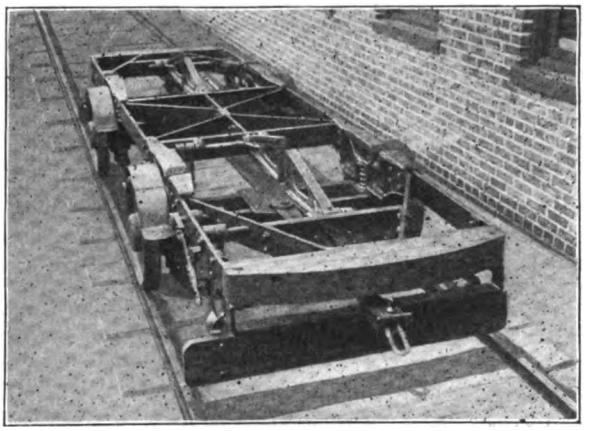


FIG. 4.

wheels. The output of flour per man per day in those mills did not exceed ten barrels. At the great Winnipeg and Keewatin mills and at Minneapolis the milling business has been so concentrated that to-day the output per man exceeds one hundred barrels and the cost of production is correspondingly reduced. But of what benefit to inaccessible property in the interior is this reduced cost of production, unless like facilities for transportation are afforded?

The measure of benefit which any improvement in production in one community bears to another community, depends entirely upon the transportation facilities between the two places. Recently a customer came into our office from one of the interior mining plants. We estimated the plant he required would cost $1,255. To help him out all we could, we eliminated every possible item not absolutely essential to the proper working of the plant, and allowing also for erector not being required, we found we could reduce our price 10 per cent., making the net total $1,130. But how insignificant our discount appeared when we learned the freight from Montreal to the mine would cost $1,248, notwithstanding no part of the route required mule-back transportation. Although further distant from Montreal, the same plant could be transported to Vancouver for less than $250.

Concentration of population and production requires for the better equalization of supply, and price of materials and provisions, that such centres must be provided with commercial veins and arteries which shall quickly and cheaply transport or exchange urban and suburban passengers and commodities. While long haul rates of transportation by railroads and steamships have been wonderfully cheapened, there still remains a space of fifteen to twenty-five or even forty or fifty miles surrounding every commercial centre, which has never been covered by any cheap method of transportation. Such distances are beyond the possibility of cheap or efficient service by animal power, and the terminal charges and bulky plant required, preclude any possibility of much reduction in railroad tariffs.

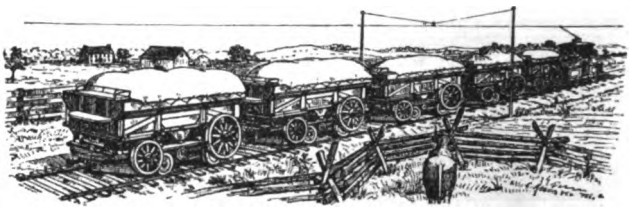


FIG. 5.

What we require therefore is a new system of transportation which shall be alike available for freight and passengers.

The problem of handling exclusively passenger traffic is comparatively simple; indeed, it has already been solved for those districts where the population is sufficiently dense to support steam or electric tramways requiring no other source of revenue. Experienced railroad men are unanimous, however, in agreeing that no road, whether steam or electric, will pay in a thinly settled district unless assisted by a bonus or by the addition of freight traffic.

In this day of great competition capital is constantly seeking methods for reducing costs. Manufacturers calculate even the individual bristles required to make a brush, and the ounces of warp in a yard of cloth. An extra hair in a brush or an ounce of warp more than is necessary, does not amount to much in a single brush or a yard of cloth, but the savings in a day's output might make a perceptible increase in the dividend account. Cost of operation and maintenance are to-day the great factors in every commercial or manufacturing calculation. Capital is ever ready to supply the installation provided it can be insured a fair return on the investment.

In 1894 the writer promoted a scheme for uniting one of the large commercial centres on Lake Erie with several surrounding counties by a system of electric railways which would combine both freight and passenger traffic. The arrangement was such that the farmers anywhere along the line would secure the immediate benefit of the higher city market rates for their produce, as well as competitive selection and prices for supplies. Local and sub-stations were to be established at frequent points along the line where the farmers could deposit their produce to be forwarded by next train to a central clearing house in the city from whence it could be delivered at once to the consumer. The scheme was to be co-operative in a measure, the

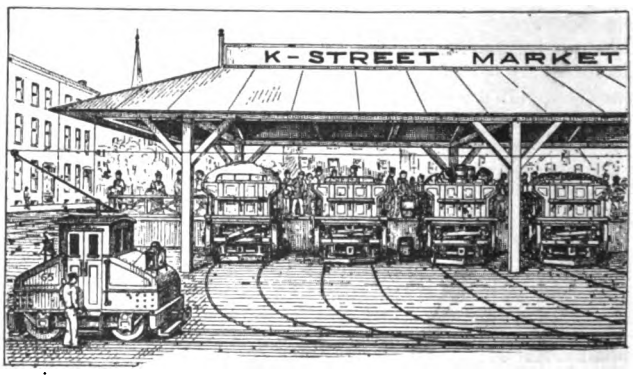


FIG. 6.

subscribers to receive the first benefits. Telephone connection was to be established between the city and farm residences through the company's local stations, and direct orders for goods from the city merchant could be received by wire and despatched by next train out. Only samples, or a very limited supply of staple goods, were to be kept at the local stations,

Digitized by Google

the principal stock to be maintained at the central clearing house, and by the various city merchants who belonged to the syndicate. Electric current for light and power was also to be supplied to consumers along the line. In short, it was proposed to so unite city and country by wire and rail that all would enjoy equal facilities for obtaining supplies.

Unfortunately the financial depression of that year so handicapped our efforts that we were unable to carry out the project, but those who gave the subject most careful consideration at the time still expect to see some such system as the above in general use.

The latest development in the line of providing for goods traffic on electric tramways came to the writer's notice some months ago in the shape of a combination vehicle, so constructed as to be readily convertible for use upon any ordinary roadway or upon a railroad track. It can be shifted from one to the other at will, without the necessity of reloading or rehandling the contents between points of shipment and destination. The idea is not altogether new, but the application will no doubt impress you all as novel in the extreme.

The Bonner Rail Wagon Company, organized about a year ago to develop the patents of Col. Jos. C. Bonner, of Toledo, O., states in its prospectus that it will build rail wagons and operate them through leases or franchises granted to interurban electric railroads. It is proposed that such roads shall be equipped with any stipulated number of rail wagons, thus enabling them to supply patrons at any point along their lines, or at the terminal stations.

The general supervision and control will be vested in the Rail Wagon Company, thus relieving the local electric railways of the detail inspection and repairing, as well as freight contracting. The Wagon Company will contract to provide service as the traffic of the electric roads may require. The wagons will be neat and substantial and tarpaulin-covered at all times, whether loaded or not, after the same manner as the goods vans are covered on English and continental railroads. This provision permits sealing and also provides protection against exposure to inclement weather.

As an essential feature of this enterprise, the Rail Wagon Company will supply horses and drivers for service at terminals, thereby retaining in responsible hands, the execution of traffic agreements, and establishing a direct-connecting link between the producer and the consumer. Agents will collect the freight charges, which charges will include delivery to consumer. The tariff rates, covering both freight and delivery, will naturally be much less than prevailing freight charges under old methods of transportation, since no allowance need be made for capital invested in expensive terminals or for maintenance of same.

Fig. 1 of the annexed cuts illustrates the integral parts of the combination vehicle. The wagon proper is patterned after the ordinary improved road wagon, modified, of course, for the special nature of the service contemplated. The running gears and springs are of standard construction having a carrying capacity of from three to seven tons, depending upon the class of freight to be carried.

The rail truck is not materially different from the car truck in general use upon our electric railways, except that it is provided with special attachments for automatically gripping and supporting the wagon proper. The truck is exceedingly simple in design and very light in proportion to its strength, being constructed entirely of wrought iron and cast steel.

Fig. 2 shows more clearly the detail construction of the rail truck and the arrangement of the cast steel segments or dogs, supported in place horizontally by heavy plate springs, and used for the purpose of engaging the axles of the road wagon as the truck approaches from either direction.

Fig. 3 shows the road wagon in position on the loading switch with rail truck underneath, the dogs engaging the axles, ready to pull ahead. As the truck is drawn forward on the level rail by the electric motor, the impact of the projecting dogs against the wagon axles also starts the wagon forward, and as the latter travels down the inclined switch track, the axles gradually settle into the notch provided in the cast iron journal frames.

Fig. 4 represents the wagon mounted on rail truck standing on the open track ready to be coupled to a motor car, or electric locomotive. Fig. 5 illustrates a train of five wagons, drawn by an electric locomotive en route across the country, while Fig. 6 represents several rail wagons side tracked in convenient market stalls, the commission agent or owner serving out the contents fresh from the farm.

The actual time required for unshipping the wagon from the truck for road use, and vice versa, is not more than would be required for coupling together cars in making up a train.

The weight of the combined wagon and truck is sufficient to insure perfect rail traction and the proportions between carrying capacity and dead weight averages about the same as the ordinary freight car.

By establishing a uniformity of dimensions and making the rail truck interchangeable, the wagons can be loaded either end on from either direction, and any number of rail wagons can be connected and moved in either direction as a train, by steam, electric or other motive power.

The farmer or merchant need have no ownership in the rail wagons. On a signal or other notice to the electric railroad, a rail wagon may be placed on a convenient farm switch or siding. The farmer readily unships the wagon from its rail truck by simply hitching his horses to the wagon and driving off, leaving the rail truck to remain where it stands until he returns with the wagon loaded for market. Convenient receiving and distributing stations can be located in the cities. Bulk merchandise can be handled; parcels, mail and express matter also, the rail wagon making store to store collections or deliveries. The movement of these road wagons need not in any way interfere with passenger service of the electric railways, the heavy traffic being carried at night, when the electric lines and streets are least in use.

The great value of this novel method of handling goods traffic is readily demonstrated. Not only does it insure economy of time, labor and expense by avoiding reloading in transit, but the reduction in breakage which usually attends the shipment of eggs, glassware, pressed brick, or other fragile commodities, guarantees for it preference over other systems of transportation.

With these changed conditions of suburban traffic the greater part of the haul would be by rail, consequently the weight of the load units can be greatly increased. A team of horses can exert, for a short period, twice the average tractive pull which they would be able to exert continuously throughout a day's work, and, so long as the resistance on the incline is not more than double the resistance on the level, it follows they would be able to draw over short hills the maximum load they are capable of drawing along a level road.

Such a system as the above would at once render accessible endless acres of fertile interior lands, and open them up to the systematic energy of the thrifty market gardener, the dairyman and the fruit grower. Improved conditions would result to the truck farmer, who would no longer be obliged to spend his night in long weary drives in order to reach the early market. Instead, his day's harvest would be transported to town during the night by electric rail wagon while man and horse refresh themselves in sleep.

Thus would we increase the market value of distant agricultural lands, and at the same time retain present values of nearby property. With the increase of land values and production, must also come increased traffic for existing or proposed suburban railways.

Large Railway Storage Battery Plants for Chicago Elevated Railroads.

Mr. Frank H. Clark, manager of the Chicago office of the Electric Storage Battery Co., reports that they have just closed a contract with the South Side Elevated Railroad, of Chicago, for two electric storage batteries for about 700 horse power each; one to be installed in a sub-station on their property at Twelfth street, and the other in a sub-station on their property at Sixty-first street. Each battery will be provided with tanks and bus-bars of suitable size for doubling the capacity of the battery. The batteries will be placed in parallel with the line, and so arranged as to take care of the maximum fluctuations, relieving the power house of a portion of its load, and at the same time keeping up the potential at the extreme points on the line. This will be the largest installation that has yet been made for feeder regulation, so that when completed, Chicago will have the largest central lighting station battery and the largest feeder regulation battery installation yet installed, the central station plant being that of the Chicago Edison Co.

Digitized by Google

Power Consumption in Electric Railroading.—I[1]

BY S. T. DODD.

I SUPPOSE there are several here to-night who will appreciate my feelings when one day, about ten years ago, I visited the city of Boston and there saw an electric street car propelled by the power of forty horses. To my mind, acquainted only with ordinary two-horse traction, a double 20 h. p. equipment seemed out of all proportion to the speed and size of the car.

Our ideas on such subjects have changed since those days, and to-day no one would think of using less than a double 25 h. p. equipment for street railway work, while double and quadruple 25, 50 and even 75 h. p. equipments are so familiar that they pass through our streets without comment.

I do not suppose any member of this club would expect to operate a 20-ton car at a speed of thirty miles per hour, with the current it takes to run an arc lamp, yet such a mistake would be no more glaring than some that have been made in the development of electric traction. What I propose to do to-night is to attempt to make an analysis of the losses occurring in electric railway operation and to show that the power of our equipments is no greater than might be expected upon the ordinary laws of mechanics, from the weights we are propelling and the speeds, acceleration and grades which we encounter.

The power necessary for propelling a car or train is equal to the product of the quantities: the speed, which is a quantity,

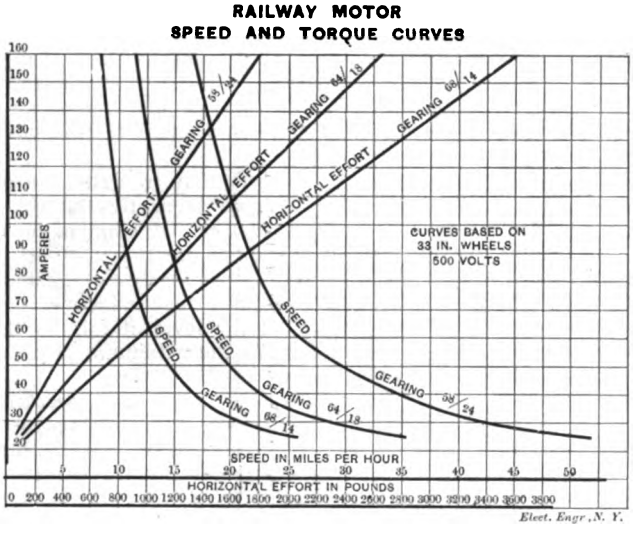


FIG. 1.

definite, measurable and easily recognized, and the force, the effort exerted by the motive mechanism, or its equivalent the train resistance. The latter being more obscure and less easily measured, deserves a careful study.

In analyzing the train resistance, four principal divisions must be noted: (1) Grade resistance or the effort necessary to lift a train up a certain slope. In electric railroad work this becomes a more important factor than in steam railroad work, on account of the steeper grades we encounter.

(2) Curve resistance, or the effort necessary to propel the cars around curves upon the track. This enters in as such a small factor that I shall only note it here for the purpose of completeness and shall not refer to it again.

(3) Acceleration resistance, or the effort necessary to carry a car of a given weight to a certain velocity in a certain time. On account of the character of the traffic in electric railroad work this becomes a more important factor than it is in steam railroad work.

(4) Frictional resistance, or the effort necessary to propel a train at a constant velocity over a level track. This division being the most obscure shall receive our attention first.

FRICTIONAL RESISTANCE.

The nature of the resistance encountered by moving trains has been discussed by steam railroad engineers for many years. I might stop here to note an advantage which we have in electric railroad work over steam railroad engineers in the measurement of this quantity. In steam railroad work readings from a dynamometer interposed between the engine and train only give the resistance of the train itself, leaving out of account the resistances experienced by the engine, which, in many cases, amount to a very considerable proportion of the whole. While the reading of steam engine indicators is a sufficiently laborious and delicate operation on stationary engines, it is much more so when the position of the observer is on the outside of a locomotive running at 25 to 60 miles an hour, and even with this indicator reading, unless the efficiency of the engine is very accurately known, as it seldom is, we are unable to separate the quantity, train resistance, from the internal losses in the engine.

On the other hand, the determination of this quantity in electric railway work is a very simple matter.

Fig. 1 represents the curves of torque and speed of a street railway motor. These curves can generally be obtained from the manufacturer of the motor; or if necessary, their independent determination is a very simple matter. The perpendicular height of any point on either curve represents the current flowing into the motor, while the horizontal distance from the left hand side of the sheet shows upon one curve the speed in miles per hour at a fixed voltage and upon the other curve, the horizontal effort in lbs. which the motor will exert at the tread of the driving wheels when it is taking this amount of current. In order to determine the effort exerted by a car equipment, it is only necessary to place an ammeter in circuit with the motors, and the reading of this by comparison with the curves of the particular motor gives us immediately the horizontal effort exerted by the motor at that instant and, approximately, the speed. For example, supposing the motor in question is geared with 24 teeth in the pinion and 58 teeth in the axle gear, the two curves marked "Gearing 58/24" in Fig. 1 show that when 30 amperes are flowing into the motor it will exert a horizontal force at the rim of 33-inch driving wheels of 120 lbs. and the car will be moving at 42 miles per hour with 500 volts at the motor terminals. If the ammeter reading is 125 amperes the same curves show that the effort exerted is 1,320 lbs. and the speed is 17.5 miles per hour. I say "approximately the speed" because the speed is dependent upon and almost proportional to the voltage at the motor terminals, and as this fluctuates in electric railway work anywhere from 10 to 20 per cent. the speed cannot be determined without a simultaneous determination of the voltage. The torque exerted by the motors, however, is independent of the voltage; a certain current flowing through the coils of the motor will develop a definite pull at the armature shaft. I am aware that this statement contradicts a popular impression that a series wound motor will take more current to drive a car at a low voltage than at a high, but it can be shown that the statement is absolutely true, and that the popular impression is the result of mistaken, or rather, misinterpreted, observations.

[1]A paper read before the Civil Engineers' Club of Cleveland, O.

Electrical Canal Traction in Europe.

A French company have just requested the French, Belgian and Dutch governments to allow them to establish along the navigable rivers and canals in these three countries a system of electric traction, in order to form an international network of electric towage, which will stretch from the Rhine, in Holland, to Marseilles, through the eastern provinces of France. Several canals in the north of France are to be connected with the Upper Meuse. It is urged that when this project is realized a great and probably favorable influence will be exerted upon the French and Belgian coal mining industry.

ROME, ITALY. The Electricitäts-Gesellschaft Felix Singer & Co. Act.-Gesellschaft has been recently given an order by the Società Romana Tramways Omnibus at Rome for the electric equipment of 30 motor cars, each with two Walker motors. It may be noticed that this order was given after experience with the Walker material in trial installations.

THIRD AVENUE ROAD has permission to change its motive power to electricity on the cable routes, but the Railroad Commission withholds its present consent as to use of compressed air or of storage batteries. When the company is ready for these, it can ask again.

Digitized by Google

ELECTRIC LIGHTING.

The 1898 Report of the Detroit Municipal Electric Light Plant.

THE Public Lighting Commission of the city of Detroit has just published its report for 1897-8, on the working the city lighting plant, and appears well satisfied with its work, although "the results from labor will not compare as favorably, for the reason that slightly higher wages are paid and much shorter hours of work are obligatory." The Commission has reorganized its staff to get the most work out of it under the conditions. Each trimmer now has from 59 to 74 lamps on 7⅜ miles of average circuit, the trimmer walking, and then doing no further work. We quote in extenso from the report as follows:

"By these economies the Commission was able to reduce the cash outlay per lamp from $64.19 per annum for a monthly average of 1,564 lamps for the preceding year, to $51.85 per annum for a monthly average of 1,744 lamps. The reduction was largely in the item of labor, being reduced from $43.57 per lamp to $33.27 per lamp, while the reductions in the cost of supplies was from $20.62 to $18.58 per lamp.

"To arrive at the cost of an arc lamp to the city of Detroit per annum, there should be added to the above cash cost of $51.85 a certain amount for interest on the investment, for loss of taxes through the plant not being owned by private parties and for depreciation. The first two items are easily computed, for the average investment for the year was, in round numbers, $750,000.00 with interest at 4 per cent, and the assessed value of the same was placed by the City Assessors at $400,000, with the rate of taxation at $17.68 for the City and at $3.24 for the State and County, a total tax of $20.92 per $1,000; but with the latter, that is, the figuring of the depreciation, there is a wide difference of opinions. As per the statistics published by the "London Electrician," of England, it is customary for the municipal lighting plants of that country to set aside annually about three per cent. of the entire investment as part of the expenses for a sinking fund. The writers on the subject in scientific journals in the United States have ranged from 3 per cent. to 7½ per cent. as the amount to be charged off for depreciation or for a sinking fund. This Commission held in its preceding report that a plant established and maintained similar to the Detroit City Plant should not be subjected to a heavy expense item for depreciation or a sinking fund. The Commission held that only a "wear" depreciation should be charged, and then only on such parts (as boilers) which, after a period of time, would have to be changed as an entirety. As a compromise, however, the Commission takes the rate of 3 per cent. to set aside with the cost of a lamp per year for a sinking fund or depreciation, and the reader may change that rate as per his pleasure. Computing these fixed charges we have:

Interest at 4 per cent. on $750,000 average investment	$30,000
Depreciation at 3 per cent. on $750,000 average investment	22,500
Taxes at $20.92 on $400,000 assessed valuation	8,368
A total of	$60,868

"Proportioning this on the basis of the electrical output and we have $55,207.27 chargeable to arc lighting, or $31.65 per annum per arc lamp. The total cost of an arc lamp to the City of Detroit per annum on these figures may, therefore, be placed at $83.50.

"In February, 1893, the Detroit Electric Light & Power Co. offered to light the City of Detroit for a period of ten years at the rate of $102.20 per arc lamp per year. While there are no recent bids available from which the exact cost to the City of an arc lamp by commercial companies may be obtained, it is entirely reasonable to presume that in common with all other industries, the cost per lamp has been reduced at least 10 per cent. during the interval of five years which has elapsed. The cost, therefore, at present may be assumed to be not greater than $90 per arc lamp per year. For a number of reasons it is believed that the rate of $90 per year is a conservative figure which may be justified.

"Taking that assumption as correct, it will be seen that the amount per arc lamp which the City has saved during the past year, after allowing the 3 per cent. for depreciation, as compared with the cost of the same lamp by a commercial company, was something less than $7. This narrow margin, the Commission believes, fully justifies its course in reducing the expenses during the past year to the lowest minimum possible consistent with the best service and the limiting conditions under which a municipal plant must always be operated.

"While it is possible that improvements in some machinery may be made soon, which would cause a partial loss to the city of the value of part of its investment in machinery, on the other hand it is only fair to state that there is an equal probability of compensating improvements in other devices and which will enable the City to further reduce the cost per lamp per year. Reductions in cost, due to such improvements, of course would not accrue to the City if it already had a lighting contract extending over a period of years.

"The ultimate success of the plan of municipal ownership of a public lighting plant, viewed from the standpoint of economy to the taxpayer, can not as yet be claimed to be assured in the City of Detroit. Time is an essential element of consideration in arriving at a judgment at all valuable upon this question. The plant, the business of which we have the honor to administer, has been in existence since April, 1895, but it is only since November 1, 1897, that the construction feature of our business was completed and the plant placed upon a purely operating basis. This period is entirely too short to justify absolute conclusions as to the ultimate success of the municipal venture from an economical view.

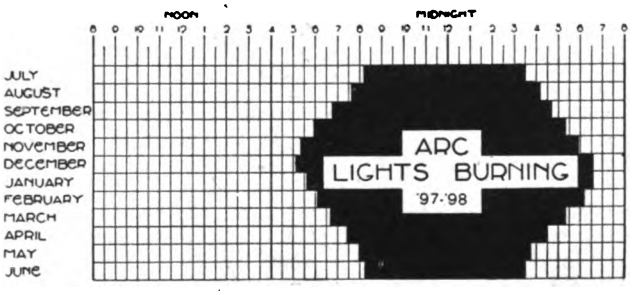


CHART REPRESENTING PERIODS OF ARC LIGHT BURNING AT DETROIT, MICH.

"The margin of profit per lamp at the present time, while it is not large, nevertheless is a showing to the advantage of the City, which it is to be hoped will be maintained or increased in the future. It is but just to observe in this connection that the quality of light furnished has been uniformly of the full standard of 2,000 candle power, which is better than was found practicable to obtain of contractors; and also that collateral advantages not easily reducible to terms of pecuniary value have accrued to the City by reason of its operation of its own lighting plant. The results, such as they are, have been secured by the Commission only by the practice of the strictest economy and the rigid exclusion of all of those elements so apt to intrude into the administration of public municipal affairs, and which operate only to confound business principles and political expediency in perplexing entanglement. It has not been at all times easy to persuade some that these two policies occasionally clash irreconcilably, and, in the determination of the one or the other to be followed, it was the duty of the Commission to be guided solely by the interest of the taxpayer."

Annexed to the report and its financial details are a number of handsome illustrations of the plant, and one interesting diagram, which shows the distribution of lighting through the year. The diagram is reproduced herewith.

COMMISSIONER KEARNY will try 500 Welsbachs in street lighting in Brooklyn. We refer him to the report of City Superintendent of Lighting, Mr. Hopkins, of New Haven. The results are all there.

SANTIAGO DE CUBA having surrendered is returning to the ways of civilization. The electric light plant has been put in operation again.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 9, 1888.]

Vol. XXVI. NEW YORK, AUGUST 18, 1898. No. 537.

The Detroit Municipal Lighting Plant.

FROM time to time we have had occasion to note the annual and ad interim reports of the Detroit municipal electric light plant; and we are now in receipt of the third annual report coming down to June 30, 1898. It will be found copiously abstracted in the present issue of The Electrical Engineer, and is certainly a document to be read and studied with a good deal of interest. The plant at Detroit is one on which great hopes were founded, and is one upon which many arguments for city ownership have been based. The conditions were all favorable. Well selected apparatus was carefully installed, and the Commission appears to have consisted of business men of public spirit. The plant has been on a large scale, and has thus enjoyed the opportunities for steady load and close economy, not presented by plants on a smaller plan of operation. In other words, the showing should be excellent in Detroit if anywhere.

Now, what does one find? An excellent showing, we will admit, but how different from all the terrific claims of saving to be effected by this investment of public money! The report says distinctly that with a depreciation allowance of only 3 per cent., which is grotesquely inadequate, "the total cost of an arc lamp to the city of Detroit may be placed at $83.50." It is admitted that, as far back of 1893, the Detroit Electric Light and Power Co offered to do the lighting for ten years at $102.20 per lamp. Figuring that in five years, the cost from private companies has fallen only 10 per cent., when as a matter of fact it is often 20 and 25, the report claims that it is saving the city "something less than $7 per lamp." That is, with depreciation at only 3 per cent., no allowance for water that we can detect in the accounts, and no allowance for a general proportionate share in the running expenses of the city government (for each city department ought to be debited with a certain proportion of all general city expenses) the plant saves the city about $12,000 a year. We do not believe, and we cannot admit under such circumstances that the municipal plant saves the city of Detroit a single cent of the alleged saving. It is not there.

In fact, the report itself says: "The ultimate success of the plan of municipal ownership of a public lighting plant, viewed from the standpoint of economy to the taxpayer, cannot as yet be claimed to be assured in the city of Detroit." Yet the Indianapolis "News" has the audacity to claim that the Detroit plant has reduced the cost of lighting to $51.85 per lamp, "being less than one-half what the city formerly paid to private corporations," and the St. Paul "Pioneer-Press" and other papers actually reprint such wild inaccuracies as an argument for municipal ownership. There is the report. Why do they not print it or read it?

That is the rub. Such reports, made by the friends of municipal ownership, only prove the contentions of those opposed to commercial investment of money raised by city taxation. We do not wonder that Mr. Louis Tossey, a member of the Detroit Common Council, took occasion recently to question the correctness of a quotation made from the report. The quotation was all right, but he had been led to believe all manner of roseate things. In the Lighting Board itself, Commissioner Ritter called the report "trash," but as he defended at the same time an official who was shown to be away on an excursion at the very time the books reported him on duty and "in charge," the Commissioner's views and expressions are entirely creditable to his feelings as a man and a politician. But there is a "difference" in the Board also over the report itself. It is a handsome document, with cuts on plate paper in colored inks, but it was rushed through with an eye to its effect on the League of American Municipalities, and was actually printed before the Board had even seen it, let alone approved it. The hind legs of the body kick; at least they do not work in unison with the front legs at such times.

If we want to see a really fine specimen of the way a good business man can do things when he becomes an official we have only to look at the superb administration of the War Department during the Cuban campaign. But the Detroit municipal plant does not pretend to live up to that high standard of efficiency—quite. Such as it is, however, it cannot be quoted as a spectacular achievement in the line of municipal managerial ability. It is in the same class, at long interval, with the electric lighting plant of Herington, Kansas, whose deficiency up to 1897 was $5,200, and which is now being shut down on August 15 because it runs behind over $150 a month. It is of the same breed at bottom as the natural gas plant of Toledo, O. That plant is now, we hear, in the market. It cost the city about $1,750,000, for which bonds are outstanding at 4 per cent. In eight years the sinking fund has received $10,000. The plant costs the city $40,000 a year to operate or about twice as much as the revenue derived from the sale of gas. It hardly seems possible.

We are very tired of such municipal plant humbuggery and of the idea that the man in buttons can run things better than a private citizen as soon as he gets the buttons on. The last huge scandals in New York State canal administration would seem enough to warn against further attempts to administer commercial enterprises by public officials with public money. If the service is honest it costs above the market value. If the service is dishonest, there is no end to the leakage of funds which have to be met or raised by taxation. But we suppose the process of creating new departments for Tammanies to run will go on indefinitely, the delusion and deception being far too deeply seated to vanish because of any exposure.

Peace With Honor.

IN less than 120 days this country has carried out the purpose for which it went to war, and ends the conflict with Spain in a creditable, glorious manner, its armies and fleets victorious in both hemispheres. Spain is banished from the New World, and her colonies that have suffered so much and so long pass under our flag or under our protection. The evil that Spain did will long live after her, but at least a new start has been made. So, too, in the Far East. Just what will be the conclusion there it is hard to predict, but one thing is certain—the flag will not come down where it has been hauled up. No man, no party in power, will dare propose such a thing, and the peace of the world itself demands that where we have intervened there we shall stay to govern or to shield.

Bound up with all the new policies of the present and the future are vital questions of trade. We are a commercial people, a trading and a manufacturing nation, and the point has been reached at which larger markets are welcome and necessary. From Cuba and Porto Rico and the Philippines we were shut out by discriminating tariffs. Those tariffs will no longer apply. It is very unlikely, moreover, that this country will sit still now and see itself shut out of markets to which it has had access. We have not seen the old wall of China built up from the inside, crumble away, in order to rest supinely while to our hurt another wall is built around the Celestial Empire, from the outside, to exclude us. If we have to stand by England to keep the doors open we shall do it. If England falls down we shall

Digitized by Google

do it for ourselves. The ruler or country persistently antagonizing the United States is laying up a terrible retribution.

There are important days coming in the near future, in which America will play no mean part. Europe is shrinking visibly as compared with this United States and the other new nationalities growing up outside the Old World. The Atlantic is to-day not less, but the Pacific is more, and with the Nicaragua Canal cut our country will dominate both oceans irresistibly. Our responsibilities will be great, but it was never yet the disposition of the races underlying the Yankee breed to shrink from responsibility.

Out of the changed conditions will come a larger trade, and in the export of our products such articles as machinery, steel and iron and electrical apparatus will furnish a large proportion. Providence has favored us with skill to invent and build, and with illimitable stores of raw material, as well as with vast areas for the cheap growth of food. It would be strange indeed if we could not manufacture in the long run and at no distant date on a scale to transcend precedent and to defy competition.

Americans are not boasting in these days, and the above remarks are not intended to wear any aspect of self-glorification. On the contrary, the war has sobered us all, as the Civil War did, but it leaves behind it, as did that struggle also, a sense of national responsibility that must be and will be lived up to; a determination to be worthy of high destiny, and a conviction of ability to achieve and accomplish that cannot condone shortcoming of any kind in those who would lead among us. The country has no use for "small Americans" in large places.

The Present Status of the Calcium Carbide Industry in Europe.

WITH a big boom and many an unpleasant "bang," the new illuminant and so-called commercial revolutionizer, acetylene, was ushered into the field of practical technics a few years ago, in the expectation that it would furnish the ideal light, and work wonders in agriculture, medicine, and other fields. That it has not, as yet, done all these things, need not be pressed, but it certainly has done one thing which should be written to its credit, namely, it has given new employment to the electric current, and that on a very large scale, in the production of its parent, "calcium carbide." This has been brought about chiefly by the very extensive and highly commendable use of the new gas for the enrichment of illuminating gas used at present, and its employment for this purpose is steadily on the increase.

The commercial production of calcium carbide is of somewhat recent origin, in fact, only since the electric furnace was employed for smelting the lime and carbon. The German chemist, Wöhler, produced it in 1861; Berthelot, by another method, in 1866; Thos. L. Willson claims to have accidentally discovered the substance in 1888, and Moissan, the celebrated French scientist, read a paper on the production of it in an electric furnace, in 1892. Dr. L. K. Boehm, of New York, however, claims priority to all others in the production of the material by employing the electric current by referring to his patent filed Nov. 5, 1891, and granted on Dec. 24, 1895, a few months after the patent was granted to Mr. Willson, whose application was only made in January, 1895. This question of priority, however, interesting as it is, we will not discuss at present. What interests us to-day is the enormous production of calcium carbide in this country, cheapened by the power from Niagara, and the reports on the present status of carbide works in Europe.

Principal among the European carbide producing countries should be mentioned Germany, where, according to Consul General Mason, the demand has far exceeded the supply. This has necessitated the importation of large amounts of carbide from America and from Neuhausen, Switzerland, where enormous water powers are available for the running of electrical plants. It appears as if the whole carbide industry, so far as central Europe is concerned, is now in a transition stage and that the conditions of supply and price are likely to be greatly modified by the increased production of the coming year. One of the most important factors in this connection is the great combination headed by the Schuckert Electrical Manufacturing Company, at Nuremberg, which it is stated on good authority will increase its capital to $7,000,000. They expect to have in operation during the course of next year, carbide factories at Gampel, Sarpborg (Norway), Bosnia and Brega (Catalonia), with a total of 18,000 horse power and an estimated annual output of 20,000 metric tons, capable of generating 211,896,000 cubic feet of acetylene. Besides these, the Aluminum Industry Co., of Neuhausen, is constructing a 7,500 h. p. plant at Land-Gastein, Austria. In all these establishments, the electric current will be used for the smelting together of the carbon and lime. A Leipzic company, with works at Cassel, are using the heat of darting acetylene flames for the smelting process, but it is questionable whether this new process can be made to compete economically with electrical heat generated by water power under favorable conditions; such as in use at Verrier, near Geneva, where the manufacture is carried on by means of the wasted water power of the Geneva electric light station. The use of acetylene for smelting the carbide seems somewhat of a reversible process, similar to running a dynamo by a motor which receives its current from that dynamo—a rather uneconomical method.

Another important fact which might be mentioned here is that calcium carbide is a somewhat critical kind of merchandise for international traffic, on account of the requirements of railways and steamship companies in respect to packing. These are so costly and difficult of fulfilment, that recently a large order of carbide for China had to be canceled because it was impossible to comply with the specifications for its transportation. Hence the desirability of local production.

The production of the substance in this country is in a most healthful condition, as may be judged from the following figures: The entire production of carbide in this country in 1896 is stated to have been 860 tons, and in 1897 it rose to 1,925 tons, while the Willson Company are stated to have produced 3,000 tons of carbide since January 1 of this year.

With these figures before us and the increased demand for acetylene for gas-enriching purposes, it would be rather difficult to set bounds to the future of the calcium carbide industry.

Trolleys on the Brooklyn Bridge.

THE cities of Brooklyn and New York have recently been greatly agitated by the report that the running of the trolley cars over the Bridge has injured some parts of the structure and made travel dangerous. We are glad to note that all who can speak on the subject with any authority assure the public that the danger, if it really exists at all, does not affect the Bridge proper but only minor, supplementary parts of the structure. The Bridge is held up by its cables and not by the framework under the roadways, where the "buckling" of the chords came, due to the heavy strain thrown on the "overflow stays." It is said that with a few remedial changes the structure has been put and will be kept in as strong and sound a condition as it ever was.

This is the second scare that has been raised over the use of electricity on the Bridge, and neither has been fully sustained, although both may have served a useful purpose in stimulating that vigilance requisite to the proper maintenance of every great engineering work. It was alleged that by the introduction of electricity on the Bridge a bad condition of electrolysis had been set up in the cables. Considering that the cables are anchored in huge masses of stone and concrete, that would seem improbable, but if it were possible we believe a sharp eye will now be kept open and all precautions put in force.

The Bridge as it stands to-day is in all probability a safe and sound structure, and to preserve it in such condition compels those in whose hands its life is entrusted to take care that no undue strains are placed upon it. This is no time to scoff at danger, but to devise means to remedy the necessary evils of transporting with safety large throngs of people in a short time during certain periods of the day. One cure, and one which should be applied at once, is the enforcing of the rule compelling the motormen to keep a headway of 102 feet between cars. This distance can be easily judged by the men themselves, if they remember that the trolley poles on the bridge are placed 50 feet apart. In the second place, the bridge should be, and doubtless is, carefully inspected at frequent intervals and constantly kept in good condition. The final remedy lies in subdivision of the traffic, or in other words, in the speedy completion of the new East River bridge. In this and in the construction of yet other bridges we may place our hopes as to the safety of the present imposing structure and the extension of electric roads.

Digitized by Google

NEWS & NOTES

The First Regiment U. S. Volunteer Engineer Corps.

THE departure from New York harbor last Wednesday, August 10, for the front in Porto Rico, of the First Regiment of the U. S. Volunteer Engineer Corps makes this a fitting occasion to review briefly the work that has been done in the last three months in getting this fine body of men together and in dispatching them, well trained and well equipped, to the scene of active operations. It is true that at this moment, when Spain seems to have got all she wants, there is a brighter prospect of peace than when the regiment sailed; but it will be strange indeed if engineers cannot find plenty to do in the West Indies that will inure more to the benefit of the beautiful islands henceforth under our care than "potting" a few miserable Spaniards.

GOING INTO QUARTERS AT CAMP TOWNSEND.

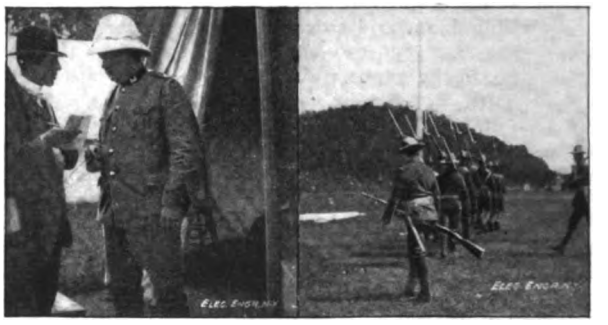
If there is any part of the world that needs engineering, it is the Spanish West Indies.

For electrical engineers, this Volunteer Engineer Corps has had a deep interest from the start. One of the prime movers in its organization was Capt. (now Colonel) Eugene Griffin, U. S. A., vice-president of the General Electric Co., himself an engineer of national reputation, and a man whose work when in the Engineer Corps at Washington is well remembered there. Besides this, the regiment as a whole, officers and privates, has been largely recruited from electrical ranks and from allied lines of engineering, so that in a way there is a distinct electrical tinge to the whole body. A great deal of the preliminary recruiting was done through Capt. Griffin's office in the Edison Building, until the scene shifted to the Army Building on Whitehall street, and then to Camp Townsend, at Peekskill, on the Hudson. As a matter of fact, the growth of the regiment was rather slow, from the very abundance of the material offered; and the scrutiny exercised was rigorous enough to satisfy the most exacting and critical. It is to be noted also that the regiment has been made up on a very eclectic basis. It has an enormous percentage of college bred men not only on the staff but in the rank and file. Almost every commissioned officer is a graduate of a university or technical college, Cornell, West Point and Harvard being well in the lead, with Yale in second place, and Columbia, Johns Hopkins and the Massachusetts Institute of Technology in the third place. Taking the regiment as a whole, Cornell is said to be most largely represented, with the University of Pennsylvania perhaps second. With such highly educated men permeating the regiment and many of them coming straight from their professional engineering careers are carpenters, riggers, linemen, dynamo tenders, bridge builders, boatmen, miners, locomotive and stationary engineers, etc., a wonderful aggregation of men who have been trained to do thoroughly something that fully justifies their selection and makes the regiment perhaps the finest body for technical skill ever got together in this country for a specific purpose of this kind.

About the last week in June, the regiment began to assemble

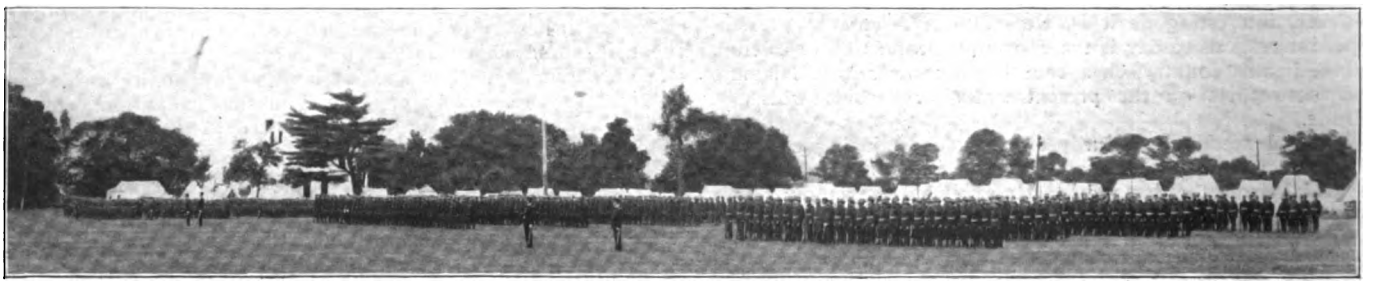
THE VOLUNTEER ENGINEERS AT CAMP TOWNSEND.

bit by bit at Camp Townsend, and Col. Griffin, now having been commissioned, took the men in hand, with his officers, to lick them into military shape. Necessarily a good deal of time was put into regular infantry drill, but it was engineering work the men all wanted to get at, and they probably had their fill before they struck their tents and came down the river to embark. An observer of the scene of departure, on August 4 and 5, says: "We cannot too highly praise Col. Griffin for executive ability



THE COLONEL. THE HIGH PRIVATE.

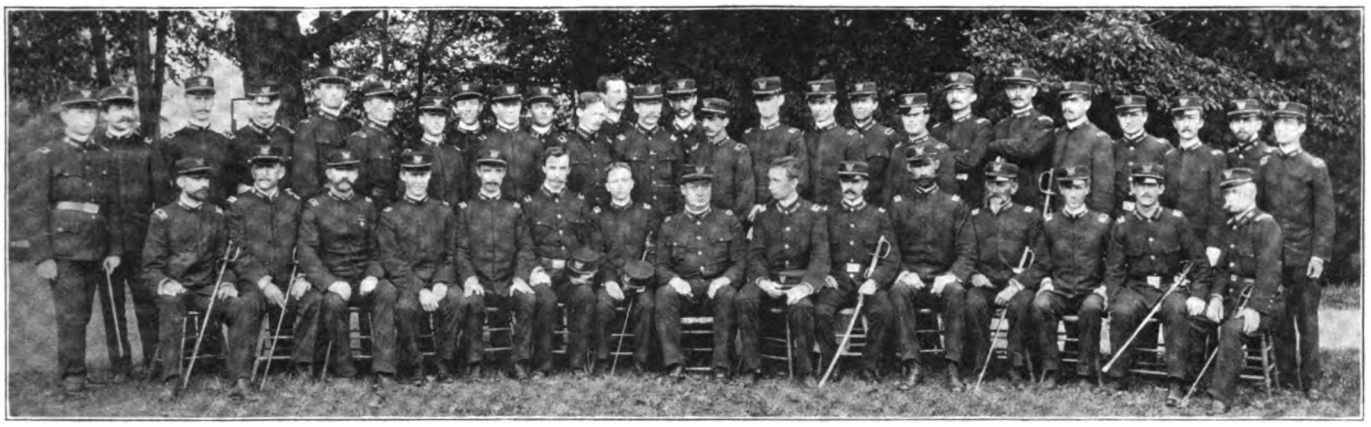
displayed in the orderly departure of his regiment from Camp Townsend. Nothing was forgotten—everything connected. The transports were in readiness at 3 o'clock, and lay at a dock two and a half miles from the camp. At an early hour each officer's effects were packed and ticketed. The men waited, quietly and orderly, each and all equipped, even to a package of bread and meat for the sail down the Hudson. No confusion, no hurry, no noise. Capt. Shaler, an officer of ability and precision, was detailed to see that the camp was left in perfect order. Not a bit of paper or crust of bread marred the outlook; not a man ill, save those who had been stunned by the lightning storm of Thursday. A splendid-looking lot of men these 1,200 engineers —steady, law-abiding, intelligent. And so, on the calmest and most beautiful of evenings, they floated down the Hudson River and found the City of Chester in the harbor, near Bedlow's Isl-



FIRST REGIMENT, U. S. VOLUNTEER ENGINEER CORPS, ON PARADE, CAMP TOWNSEND, PEEKSKILL, N. Y.

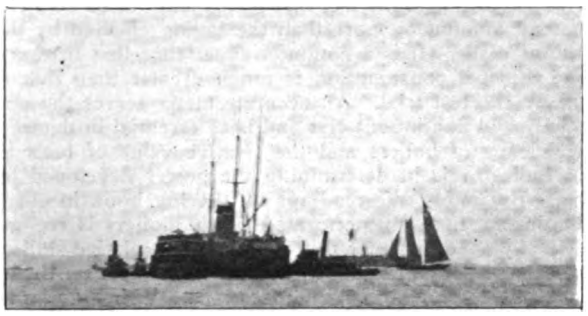
Digitized by Google

and, awaiting them. There has been so much said about the confusion and misery incident to the embarking of our troops that I feel it my duty and pleasure as an eyewitness to give to Col. Griffin his justly earned praise. Surely that was a master mind that organized the leave-taking of the First New York Volunteer Engineers."



COL. EUGENE GRIFFIN AND OFFICERS, FIRST REGIMENT, U. S. VOLUNTEER ENGINEER CORPS.

Arrived in the harbor, the men found the City of Chester awaiting them, but had three of four days of uncertainty and delay, while the steamer was being got fully ready and loaded for her voyage. The regiment occupied a good position of vantage in the middle of the harbor, and spent no small part of its time exchanging cheers with pleasure and business craft, until at last it was humorously proposed to have a regular detail to attend to that patriotic function. Before it left, the regiment was presented by the Engineers' Club of New York with a stand of colors, which was highly appreciated. President Thomson, of the club, was active with other members in raising a subscription to present the regiment with a portable field electric searchlight, and he also secured for it from the Colt Armory a beautiful Colt rapid-fire gun, which the men received very enthusiastically. In fact, the gallant Volunteer Engineers were made to feel and know in many ways that their brethren staying behind took the deepest concern in their welfare and would follow their fortunes with warmest interest.

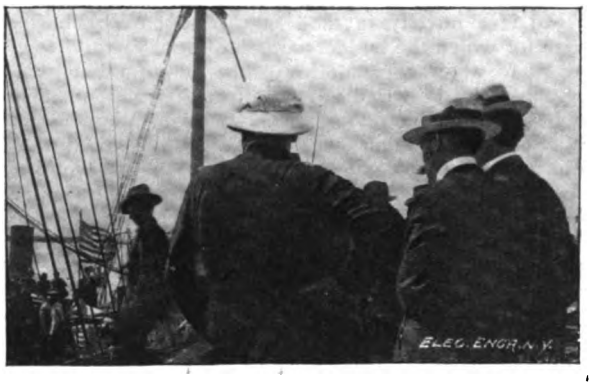


"CITY OF CHESTER" WITH TRANSPORTS, N. Y. BAY.

WHEN THE WATERMELONS CAME ALONGSIDE. CHEERING THE SANDY HOOK BOAT.

There were, of course, many indications of the calibre of the men, individually and collectively, before they left, but perhaps the best is the tribute said to have been paid them, unconsciously and in a plain, matter-of-fact way by the quartermaster, who is understood to have reported unusual difficulties in the equipment of the whole regiment with uniforms. "The trouble is," he said, in a moment of perplexity, "I have clean run out of large sized hats and small sized shoes." This is one of the stories so good and neat that if not true it deserves to be. We do not know that the Engineers would ask any higher compliment, except to be known as brave; but that glory the whole army shares with them.

Our pictures speak for themselves. For the photographs of the staff and the regiment on parade, we are indebted to Manser, the Peekskill photographer. The smaller views are from snap shots secured by Mr. W. J. Clark, railway department manager, General Electric Company, who both at camp and on the City of Chester took a great many characteristic bits. It will be seen that the men went at their work and play very heartily, making a good record in camp and adapting themselves with cheery good humor to the unwonted cramping conditions of a troopship. During the stay in the harbor, under the blaze of an August sun, lying at anchor, life was not altogether a grand sweet song, and the boys were delighted when Col. Griffin secured for them two pleasant barges and moored them alongside, so that they could stretch their legs in the daytime and find hard, cool planks at night. But all these discomforts were forgotten at last in the delight of sailing away to encounter others of a worse description, as well as possible loss of life or limb, for the glory of the Stars and Stripes.



WATCHING THE EMBARKATION IN N. Y. BAY.
Col. Griffin. Ed. Elec. Engineer.
John Thomson, Pres. Engrs'. Club.

Digitized by Google

Extension of Electric Traffic at the New York and Brooklyn Bridge Terminus.

On Monday week, the new motor cars with which the Brooklyn Elevated Railroad Co. has been experimenting began their regular trips across the bridge. They are used to draw the elevated trains from Bridge street across the bridge and back again, making a continuous trip. They have been working very successfully and the officers are so well pleased with the tests that it is only a matter of time before the system will be extended to all the branches of the line.

It is expected that the new arrangement will permit the running of trains under four-minute headway instead of eight minutes headway as at present. Furthermore, it will not be necessary to make any change of cars, as is now the case, in rush hours.

Since the trains of the Brooklyn Elevated system began running over the bridge a month ago, they have been taken by the ordinary locomotives to the bridge yard, where they were attached to one of the bridge motor cars, and thence drawn out of the station to the cable.

Chief Engineer Cornell, of the company, states that the next move the company would take would be to introduce the third-rail system on the Fifth avenue line. This line is the shortest and most remunerative in the system, and if it works successfully will then be extended to the Myrtle avenue, Lexington avenue and Broadway lines.

Electrical Activity in Chicago and Vicinity.

MONTGOMERY WARD & CO., the great mail order retail house of Chicago, will put in a large electric plant for the new building it is erecting. For this purpose two vertical, cross compound 300 horse-power Allis-Corliss engines have been contracted for. To each engine two 100-kilowatt dynamos will be direct connected. The generators are 110-volt and are to be supplied by the Western Electric Company from its Chicago factory. The Allis vertical engines will run at 125 revolutions per minute and are to be equipped with a new style of valve, which is located in the cylinder heads, so as to reduce the necessity for clearance between piston and cylinder head at the end of a stroke to the smallest possible amount, thereby securing an increase in economy. This location of the valves in the cylinder head is a novelty in modern Corliss engine construction and one for which the builders are able to make some low guarantees as to water consumption. The new building this plant is to supply will be wired for 8,000 incandescent lights. Steam is to be supplied by three Heine water tube boilers rated at 250 h. p. each, 150 pounds steam pressure. With them the Hawley down draft furnace will be used. The engine room is to be fitted up for beauty as well as utility and will be finished in marble with glass partitions. The estimated total cost of this electrical plant is $40,000. Fourteen electric elevators are contemplated. One of the features of the new building is to be a tower 362 feet high, which will be the highest structure in Chicago.

A. H. Andrews & Co. are to put in a 200 h. p. plant for power transmission at their wood-working factory at Twenty-second and Fiske streets, Chicago.

Nelson Morris & Co. will change their plant at the Chicago stock yards from mechanical to electrical transmission, and for that purpose will put in 400 kilowatts in generator capacity and 650 horse power in motors. The same concern has just installed in its plant at East St. Louis, Ill., a direct current plant with 125 h. p. in motors.

The J. Gund Brewing Company in the last six months has put in for use around its brewery a 75 kilowatt three phase generator and 150 h. p. aggregate capacity in three phase induction motors, on a 220-volt system. An addition to this installation is now being made in the shape of 100 h. p. more in generators and motors.

The United States Sugar Refinery at Waukegan, Ill., has just contracted for two 180 kilowatt two phase 440-volt generators and 600 horse power in type C Westinghouse induction motors for shop lighting and transmission.

The Schoenhofen-Edelweisse restaurant at 103 Madison street, Chicago, is starting a 60 kilowatt double commutator dynamo for lighting and power purposes. This double commutator machine was built by the Western Electric Company and has proved very popular around Chicago. Each commutator gives 110 volts, so that 110 and 220-volt circuits can be run from the same machine, or if desired, an Edison three-wire system can be run from the one machine. This dynamo is run by a 12x12 Ball engine, to which it is direct connected. The speed is 325 revolutions per minute.

These plants are some of those looked after by one consulting engineer, F. D. Mack, and are only a few out of the many new projects under way in this territory. No wonder electrical manufacturers are kept busy these days.

FRESNO, CAL. Shortness of the water supply in the mountains forced the San Joaquin Electric Co. to shut down part of its plant for a time.

Boiler Test Meters—Worthington Steam Accumulator.

AT the regular meeting held August 9, of the Civil Engineers' Club, of Cleveland, Dr. Lehman B. Hoit read a paper on "Test Meters for Boiler Plants." After describing the requisites of a water meter, as attached to a service pipe to measure the total consumption, he emphasized the importance of perfection of parts and accuracy of record in the meter applied to determine the amount of water fed to steam boilers. The old method of testing boilers by weighing the water cannot be applied for general use owing to the fact that the expense of so doing would in the end amount to more than the saving effected by the observations made. It is a common experience that in every-day service the fuel consumption is much greater than that determined by the test trial. An accurate meter serves the purpose of a daily and continuous test and is as essential in determining the efficiency of boilers and the relative value of fuels as the steam indicator is in determining the power developed by the engine. By noting the readings on the log book in charge of the engineers, the duty performed by the boilers is recognized. Incidentally the test meter also indicates the relative skill of different sets of firemen and tends to prevent waste on their part. The speaker then exhibited and described a Worthington meter, and cited instances of its successful application to large boiler plants. The error in measurement in these modern machines has been proved to be only a small fraction of 1 per cent., and the rate of error being constant may easily be eliminated in the general result. The paper was discussed by Messrs. Palmer, Roberts, Porter and others.

By request, Dr. Hoit exhibited some blue prints of the Worthington steam accumulator, and described its construction and operation. As compared with a weighted accumulator, this has several advantages. It requires no bulky weight, no heavy foundations, and produces no water hammer requiring extra strength in connections. The water hammer of a weighted accumulator often amounts to 25 per cent. and sometimes 50 per cent. of the static pressure. It is particularly adapted to the regulation of plants operated by water pressure, such as hydraulic presses and passenger elevators. A sudden demand in the service by reducing the water head causes additional steam to be supplied to the pumps, and also in certain cases to an auxiliary pump, by which means the loss of head is promptly restored. The whole action is automatic and requires no attention on the part of the engineer. In large plants, and especially where the service is very fluctuating, these machines have proved very advantageous and economical. The effect of the accumulator is somewhat analogous to that of a steam governor. This subject was discussed by Messrs. Herman and Palmer, and Dr. Hoit kindly answered a number of questions.

OTTO GAS ENGINES. Up to the end of 1897 no fewer than 61,370 of these engines had been sold, of a total of 508,025 brake horse power. This does not include Otto oil engines, of which many have been sold. Of these engines, 16,193 were sold in Germany, 30,973 in Great Britain and 14,204 in other countries.

Digitized by Google

Use of Alternate-Current Motors in a Bleaching and Dyeing Establishment Providence, R. I.

THE old-time prejudice against the alternate-current motor has become nothing more than history, and it is interesting to note that this type of machine has demonstrated its superior utility to the direct current motor in a number of peculiarly trying applications.

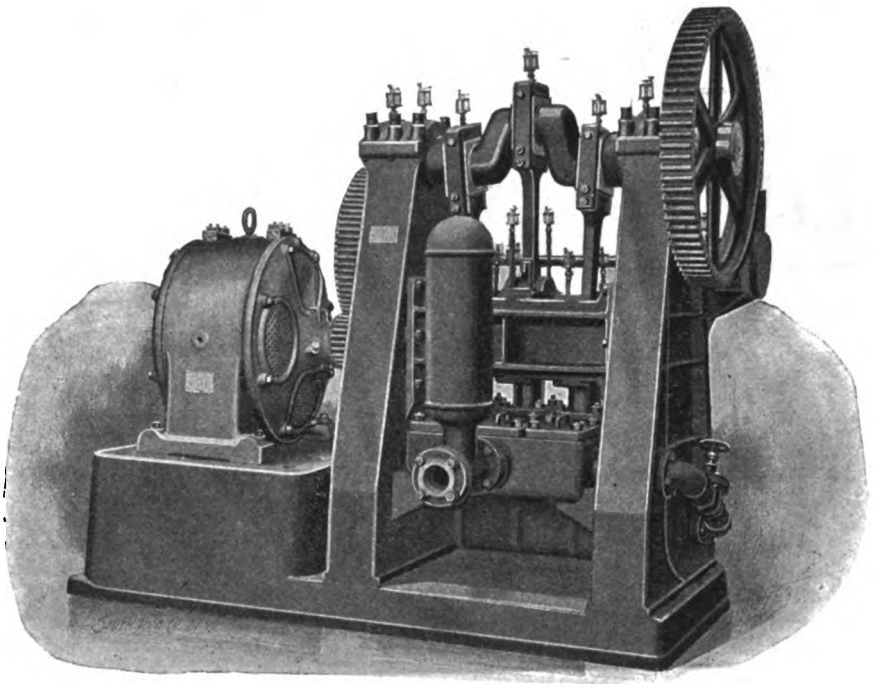
As the original promoters of the use of alternating apparatus, the Westinghouse company have been pre-eminent in the development of machinery of this type, whether in monophase or polyphase systems. The culmination of such developments to the present date is no doubt to be witnessed in the Tesla "Type C" induction motor, as made by that firm. This motor has been frequently described in these columns, and the essential feature—the absence of any connections between the mains and the rotating parts—is familiar to every electrical engineer. The installation of these motors by the Silver Springs Bleaching and Dyeing Company, of Providence, R. I., has shown their fitness for a peculiar line of service in which the use of direct current motors would be impossible.

This company, under the ownership of Governor Lippitt, of Rhode Island, was a pioneer in the use of electrical apparatus for mill purposes. Very early in the history of the use of electrical industry Governor Lippitt purchased two direct current dynamos, which were used for lighting and power service until 1895. At this time the necessity for large extensions of the Silver Springs plant induced the company to investigate the modern developments in lighting and power service. After a thorough study of the subject and visits to all the electrical factories Mr. E. C. Myrick, the company's engineer, recommended the adoption of the Westinghouse three-phase system, 3,000 alternations, for both lighting and power.

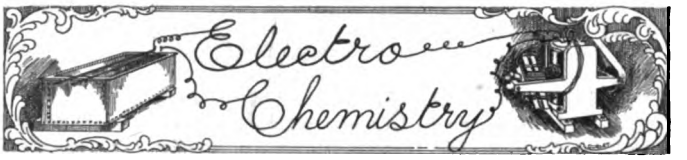
This decision was at the time severely criticised by several mill engineers, but the results of two years of active service under the worst imaginable conditions have fully demonstrated the soundness of engineering judgment manifested.

In addition to lighting the entire plant, some 30 Westinghouse induction motors of from 3 to 75 horse-power have been installed. These motors are employed for driving washing machines, ironing machines, tentering frames, triplex pumps, elevators, ventilating fans, etc., etc. Some of the motors operate constantly in a cloud of steam where a direct current motor could not run for five minutes. Many of them are subjected constantly to the action of chloride fumes, and all the copper parts of the motors and switches are green with corrosion. In many of the operations enormous starting torque is required, the initial torque in some cases being four times the normal torque of the motor.

The plant has proven so satisfactory that it has recently been extended by an installation of ten more of the Tesla "Type C" motors made by the Westinghouse Company.



WESTINGHOUSE INDUCTION MOTOR ATTACHED TO A TRIPLEX PUMP.



Commercial Development of Electro-Chemistry in England.

MR. JAMES BOYLE, United Consul at Liverpool, England, writing on the British chemical trade, says:

The electrolytical method for the manufacture of chloride of potash, bleaching powder, and caustic soda for the decomposition of salt, instead of the employment of bi-sulphuric acid, has been in use for some time in Germany, and also to a small extent in the United States. It is claimed, that by the application of electricity, the chemicals can be produced more cheaply than by the old method. The electrolytical methods do certainly produce more direct results, but local experts say that it is yet too soon to definitely decide whether they are more economical than the old method, as there are so many considerations which time alone can solve, such as the wear and tear of machinery and the cost of replacement, which are expected to be serious items of expenditure. Where electricity can be produced by water power, as in Norway and at Niagara and other places in the United States, the new process will have a better chance of success than in England, where it must be produced at great cost in the consumption of coal. The various electrolytical processes in use in this neighborhood are:

(1) Richardson & Holland's patents, which are being worked at Parr (St. Helen's), but apparently so far are not proving a

Digitized by Google

commercial success, although over $486,000 have been employed in perfecting them.

(2) Castner-Kellner's patents, worked at Weston Point (Runcorn). The company holds out the promise of being able to make a return of 8 per cent. per annum to their shareholders next year. For the last year they were paid nothing.

(3) Hargreaves & Bird's patents, works for which are being erected at Middlewich in Cheshire.

(4) The Rhondin process, for which a prospectus was issued inviting the subscription of capital. This was not allowed to go further, as the Castner-Kellner Company obtained an injunction restraining the Rhondin Company on the ground that their process was an infringement of the Castner-Kellner patents.

Speaking generally, there has been a steady decline in prices at Liverpool, dating from 1893. The following figures show the downward movement:

Sulphate of Ammonia.—In 1893, $68.13 per ton; in 1897, $40.14.

Caustic Soda.—In 1893, $46.22 per ton; in 1897, $35.88.

Soda Ash (Leblanc).—In 1893, $22.50 per ton; in 1897, $21.89.

Chlorate of Potash.—In 1893, 16 cents per pound; in 1897, 7.6 cents.

Bleaching Powder.—In 1893, $41.36 per ton; in 1897, $30.40.

Muriate of Ammonia.—In 1893, $4.86 per cwt.; in 1897, $4.25.

Carbonate of Soda.—Prices have slightly fluctuated; in 1893 the price was $19.46 per ton; in 1897, $20.67.

Sal Ammoniac.—The price has been very steady from 1893 to 1897, it being about $8.51 per cwt. for first quality and $8.02 for second quality.

M. HENRI MOISSAN has succeeded in obtaining metallic calcium free from impurities. He dissolves the crude metal in molten metallic sodium, maintained at a red heat. On cooling the calcium crystallizes and is separated by being treated with absolute alcohol. The crystals are white and shining and belong to the hexagonal system.

SOCIETY & CLUB NOTES

Fire and Police Superintendents in Convention

THE International Fire and Police Telegraph Superintendents' Association held an interesting and successful convention at Elmira last week, when a number of papers were read by members and experts—Capt. W. Brophy, on "Electrolysis and the Best Means of Prevention;" Morris M. Mead, on "Maintenance of Central Office, Embracing the Storage Battery;" W. H. Thompson, on "Aerial Construction;" F. P. Foster, on "The Difficulties of a Superintendent;" J. W. Aydon, on the work of the Association.

Special honors were paid to Dr. Channing, one of the fathers of fire alarm telegraphy, who sent a communication to the meeting and to whom a message of congratulation was returned.

Mr. Clarence E. Stump, the well known publisher of "City Government," made a very happy and suggestive reply to the mayor's address of welcome.

The treasurer's report showed a balance of $240.

A change was voted in the constitution, making dues $10 instead of $5.

J. W. Aydon, of Wilmington, Del., was chosen president, and Wilmington selected as the place for the meeting in 1899. The other officers elected are: Vice-president, George F. Macdonald, Ottawa, Canada; treasurer, Adam Bosch, Newark, N. J.; secretary, H. F. Blackwell, Jr., New York; financial secretary, Bert McAllister, Bradford, Pa.

A number of entertainments marked the occasion and good fellowship prevailed. Those in attendance were: Frank C. Mason, Brooklyn, superintendent police telegraph; William B. Green, Brooklyn, Brooklyn Daily "Eagle;" A. P. Eckert, New York City, Safety Insulating Wire and Cable Company; Frank P. Foster, Corning, superintendent fire telegraph; John B. Taltavall, New York, the "Telegraph Age;" Burt McAllish, Bradford, Pa., superintendent fire telegraph; H. H. Blackwell, Jr., New York City, superintendent fire alarm; Thomas J. Welsh, Buffalo, superintendent fire telegraph; George F. Porter, New York, Kerite wires and cables; W. S. Eckert, New York, John A. Roebling's Sons' Co.; Clarence E. Stump, Brooklyn, "City Government," New York; William A. Baines, Bridgeport, Conn., superintendent fire telegraph; Louis W. Miller, Rochester, superintendent police and fire telegraph; Morris W. Mead, Pittsburg, superintendent Bureau of Electricity; H. C. Bundy, Watertown; superintendent fire alarm; William Brophy, Boston, Mass., inspector of wires; Frederick Pearce, New York, Lema Lemon and wife, Baltimore, superintendent fire telegraph; Adam Bosch, wife and daughter, Newark, N. J., superintendent fire alarm system; Frank M. Perrin, Boston, Mass.; W. H. Thompson, Richmond, Va., superintendent Fire Telegraph Company; George T. Manson, New York, Okonite Company; J. W. Ogden, wife and daughter, T. J. Harper, Atlanta, Ga., city electrician; William Exall, Newark, N. J., captain hook and ladder company, Newark Fire Department; George F. Macdonald, Ottawa; superintendent fire alarm; William Crane, Erie, Pa., city electrician; S. L. Wheeler, Springfield, Mass., city electrician; A. C. Mackenzie, Elmira College; E. J. Fenlon, National Conduit Company, New York; G. L. Wiley, New York; W. Y. Ellett, Elmira.

The American Street Railway Association.

We are requested to publish the subjoined:

I desire to remind all our members that the next meeting of this association will be held at Mechanics' Association Hall, Huntington avenue, Boston, Mass., September 6, 7, 8 and 9, 1898. We expect to have the largest convention we have ever held. Papers will be read on live subjects. The exhibits will be a prominent feature of the meeting. Full particulars in regard to hotels, railroad rates, etc., were given you in circular of May 1. In order to secure reduced fare you must get a certificate from the agent when you purchase your railroad ticket. Headquarters at Hotel Brunswick. Please fill out and mail at your earliest convenience the enclosed card. Hoping to have your company represented, I remain, Yours very truly,

T. C. PENINGTON, Secretary and Treasurer.

Chicago, August 1.

The Coming Mechanics' Fair in Boston.

The spirit of progress which has characterized the executive committee having in charge the twentieth triennial exhibition of the time-honored Massachusetts Charitable Mechanic Association in Boston is again strikingly apparent in several important directions. Not only have the character and scope of the exhibits themselves been elevated and broadened, but the building, with its immense floor area and exhibition resources, has been remodelled and greatly improved.

Latest reports from the several departments point to the most interesting exhibition in the history of the association, and presenting to the world for the first time in history a great fair entirely driven by electricity as a motive power.

Applications for space continue to pour in, and the managers find themselves confronted by the necessity of selecting only those of the greatest public interest. This means that intending exhibitors should lose no time in inspecting the floor plans and filing early applications if they hope to be represented in the Mechanics' Fair of 1898, which opens October 10.

THE STOCK MARKET

Further Trade Improvement.

The general conditions of the country at the opening of the Fall trade are certainly better in every direction, and the reports as they come in go to show that present tendencies toward improvement will become more marked now that peace is declared.

During the past week the stock market has been strong and very active. Of Western Union 30,163 shares were sold around 94¼. General Electric closed at 41, after sales for the week of 19,605 shares. In Boston, American Bell Telephone went to 280½. New York Edison sold at 132¾.

Copper New York is quoted at 11.75 cents. Heavy steel rail, Eastern mill, is $18 per ton. There is considerable hardening in the quotations for iron and steel.

Digitized by Google

EDUCATIONAL

McGill University—The W. C. McDonald Chair of Electrical Engineering.

The Board of Governors of McGill University, says the Montreal "Witness," have appointed Prof. R. B. Owens, E. E., of the University of the State of Nebraska, to the W. C. McDonald chair of electrical engineering at McGill University, lately held by Prof. Carus-Wilson. Prof. Owens is a native of Maryland and was educated at the Johns Hopkins University in Baltimore, obtaining a high standing in mathematics and physics. Proceeding from the Johns Hopkins University to Columbia University, he there obtained in 1891 the post-graduate degree of E. E., being a member of the first class in the United States to obtain this degree. In the intervals of his college course the young student acquired a fund of practical knowledge with several well-known electrical companies. Shortly after receiving his degree Mr. Owens was appointed adjunct professor of electrical engineering in the University of Nebraska, and in 1894 he was made full professor, having in the meantime served as one of the judges of electrical exhibits at the World's Fair. Prof. Owens has recently been elected to a Tyndall Fellowship by Columbia University and is Director of Bureaux of Electricity and Machinery at the Trans-Mississippi Exposition at Omaha. He is also a member of the Western Society of Engineers, the American Society of Mechanical Engineers and the Council of the Society for the Promotion of Engineering Education, and vice-president of the American Institute of Electrical Engineers. He has contributed important articles to engineering societies and to the electrical press on the subject of electro-technics and of technical education. Since his entrance into the educational field Professor Owens' work has been marked by originality and energy. He has built up the course at the University of Nebraska to a prominent place in the rank of technical institutions, and his activities, not being limited to the precincts of the college, having taken him into outside matters of national importance. He will, no doubt, add to his reputation at McGill.

PERSONAL

MR. SEATON M. SCOTT, consulting engineer, 123 Liberty street, New York City, has just completed a set of plans for an electrical 'bus seating eighteen persons inside and four persons on top for the Electrical Vehicle Co., of this city.

MR. MARTIN J. INSULL, who has recently opened headquarters in the Monadnock Building, Chicago, as a manufacturers' agent, was in New York last week.

MR. E. L. BRAYTON, treasurer of the Pelton Water Wheel Company, San Francisco, who has been at their office in New York City for some weeks past, has gone abroad in the interests of his company.

OBITUARY

Dr. G. Q. Colton.

We note the death at the ripe age of 84 of Dr. G. Q. Colton, a famous American dentist who fifty-four years ago was closely associated with Dr. Horace Wells in some of the early work in the use of anaesthetics which led afterwards to a fierce controversy as to priority amongst several men. Some fifty years ago he went over the country lecturing on popular science, and having with him a small model railroad built by Dr. Lilley, one feature of which was the use of the track as the return circuit. A few years ago one of the editors of The Electrical Engineer traced the history of the occurrence, and at last the old model was itself found, being put on view at the New York Electrical Exhibition of 1896. Dr. Colton was interested in science to the last, and so active that he went to Europe three months ago for change. His death took place at Rotterdam. It is said he extracted one million teeth, nearly all with the aid of nitrous oxide gas, and without an accident.

J. J. Schoenleber.

Mr. John J. Schoenleber, proprietor of the Northwestern Engineering Co.'s electrical supply office, St. Paul, died on August 4 after an illness of only two days. A year ago Mr. Schoenleber underwent an operation for appendicitis, from the shock of which he never fully recovered. He was a young man of estimable character and a graduate of Iowa State College. After finishing at Iowa he went to Purdue University and completed a special course in electrical engineering. He went to St. Paul in 1893 and engaged immediately in the telephone and electric supply business. Arrangements had just been completed for organizing a stock company under his supervision. Mr. Schoenleber was born at Ransom, Ill., in July, 1866. He had taken out several patents chiefly in the telephone field.

MR. GEORGE B. RICHMOND, of Lansing, Mich., has just died, and is credited with having invented the telephone. Sorry to say we do not know the gentleman.

LITERATURE

QUANTITATIVE CHEMICAL ANALYSIS BY ELECTROLYSIS. By Dr. A. Classen, in co-operation with Dr. W. Löb, translated by W. H. Herrick, A. M., and Bertram B. Boltwood, Ph. D. John Wiley & Sons, New York, 1898. 301 pages; price, $3.00.

For a long time past there has been a demand for a reliable American treatise or translation of a work on chemical analysis in which the electric current is employed. It appears as if this demand has been admirably met by the translation of the above mentioned work, which has just made its appearance. Such a work will certainly find a ready market since the investigations of recent years have largely enriched this subject. The book contains specific directions concerning electrode tension, current strength and decomposition tension. The values given by the author have all been determined experimentally by himself and methods employed by other authors are omitted when they contain uncertain and impracticable data. The book has been made more complete by the description of various electrical instruments together with an explanation of simple and complete appliances for carrying out electrolytic experiments. The quantitative determination of a large number of metals, as well as their separation when combined, is given, and numerous applied examples of electro-chemical analysis are included. The book is profusely illustrated and well indexed, and the author has found it advisable to quote under each new metal treated all references bearing on that particular question. This must certainly prove of great value to anyone who wishes to make this subject a special study or is engaged in making electrolytic quantitative analyses.

Maver on Underground Work.

It is announced that Mr. William Maver, Jr., will shortly have in the publishers' hands a book on "Electrical Underground Conduits and Cables." Mr. Maver, it is well known, has been actively connected with electrical underground work since its inception in this country and has already written extensively on these subjects for current electrical periodicals, etc. His contributions on the subject to this journal will be well remembered. From Mr. Maver's well known attention to details in technico-literary matters it may be confidently predicted that this handbook will fill a want which at present exists in the literature of this branch of the art.

Digitized by Google

LETTERS TO THE EDITOR

Preventing Collisions at Sea.

WITH pleasure I note a comment by Mr. W. J. Clarke in your issue of Aug. 11, referring to my article "Means for Detecting the Presence of a Vessel or Iceberg." (E. E., Aug. 4.) In answer to Mr. Clarke's statement: "I am nevertheless of opinion that the use of wireless telegraphy apparatus is the only successful way in which collisions at sea can be avoided," I would repeat a statement already made in my original article, that in the employment of signalling apparatus we are dependent upon the watchfulness of the other vessels and also upon unavoidable circumstances which we cannot control. I should also like to ask Mr. Clarke in which way he would use wireless telegraphy to prevent a collision with icebergs. This apparatus needs an attendant, and it seems rather absurd to imagine a telegraph station on top of each iceberg.

The danger of collision with them prevails, and to substantiate this I quote a heading from the Newark "Evening News" of August 5, 1898: "Ocean Liner Probably Lost. Big Steamer Seen to Collide With an Iceberg and Go Down. Those on Board Unable to Escape."

The ideal method for preventing collisions at sea would certainly appear to be that which automatically indicates the approaching objects and would indicate their movements. Then we can evade danger. Even if two or more vessels would be approaching we would know exactly where they are and in which direction they are moving. With such an apparatus entire independence is established.

I understand, of course, that my device needs considerable experimenting before it can be called a practical means for the prevention of accidents at sea. However, in order to bring about a speedy settlement of the question of its practical value I repeat that discussion on it will be welcomed, and express the hope that the needed capital to carry on the investigations will soon be forthcoming. HERMANN HERBERTS.

Newark, N. J., August 12, 1898.

LEGAL NOTES

Suit to Stop General Electric Reorganization.

Suit has been commenced in the United States Circuit Court, Boston, by Thomas T. Livermore, Edwin F. Atkins and Quincy A. Shaw and the American Loan and Trust Company, all of Massachusetts, against the General Electric Company, of Schenectady. The suit is brought to restrain the defendant from decreasing the preferred stock of the company and allowing the complainants to receive their accumulated dividends.

The Value of A Child—A Trolley Accident Case.

In the New Jersey Supreme Court, in setting aside the verdict of $5,000, obtained by Abraham L. Graham against the Consolidated Traction Company, for the killing of his child, Justice Gummere holds the damages to have been excessive, and he makes this declaration: "It is the universal rule that children are expensive, and not a pecuniary benefit to the father, and yet on the theory on which this verdict is based the larger a man's family the richer he will die. In the present case, if the father of the child had a reasonable expectation of being benefited in dollars and cents to the extent of $5,000 by the continuance of the life of his child a family of ten sons would justify the assumption that at his death he would be $50,000 better off than if he never had issue."

JUDGE BATES, of Bates & Holliday, 711 Tremont Building, Boston, has prepared an article on the new Bankruptcy Law, which will be sent to any one who may make a request for it, as long as the supply lasts.

REPORTS OF COMPANIES

Westinghouse Retirement of Floating and Bonded Debt.

It is officially announced that the directors of the Westinghouse Electric and Manufacturing Company have, by authorizing the issue of $3,500,000 15-year 5 per cent. gold debenture certificates and by selling $3,000,000 of such issue, completed a financial transaction of great advantage to the company and its stockholders. The company has been able to place these certificates without creating any mortgage upon its assets, the company simply covenanting that it will not hereafter create any lien upon its property. The proceeds of the sale of these debentures will retire the outstanding floating and bonded indebtedness of the company, returning to its treasury as available assets stocks and bonds in various lighting and power companies yielding an annual income exceeding one-half of the interest charges of the debenture certificates. The saving in interest to the company will be important but inconsequential as compared with the strong position the company will hereafter occupy with its rapidly increasing trade, to care for which the company will have ample resources. The interest coupons of the debenture certificates will be paid July 1 and January 1 by the Mercantile Trust Company, of New York, which acts as trustee under the agreement, the provisions of which have, under the advice of counsel in the interest of large investors, been made to carefully guard the interests of the certificate holders.

Pittsburg United Traction Co.

The United Traction Co., of Pittsburg, makes the following statement for the year ending June 30:

Gross earnings	$1,475,764
Expenses	685,819
Net earnings	$ 789,944
Fixed charges	590,445
Balance	$ 199,499

The preferred dividend calls for $150,000, so that $49,000 is left for the common stock, of which there is $17,000,000.

GENERAL ELEC. CO. Over 95 per cent. of the stock was represented at the special meeting last week to scale down the capital stock 60 per cent., and owing to the work involved the vote was postponed until the 17th.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued August 2, 1898.

Alarms and Signals:—

ELECTRICAL SIGNALING APPARATUS FOR TRANSMITTING COMMANDS. C. Arldt, Berlin, Germany, 608,246. Filed Dec. 29, 1897. Details of construction.

BATTERY ZINC. D. Ogden, Columbus, Ind., 608,216. Filed April 12, 1897. A battery cell having a cover provided with an opening for the introduction of the electrodes, two or more electrodes with stems, and and means for securing the stems within the opening whereby the electrodes may be suspended within the cell.

Batteries, Secondary:—

BATTERY ELECTRODE. H. E. Wilkinson, Mount Vernon, N. Y., 608,537. Filed June 10, 1897. A battery plate constructed of resilient spring metal and provided with a pocket having a front slide sloping inward toward its bottom, and ends which converge in a downward direction and are at angles to the sloping front side.

Conductors, Conduits and Insulators:—

FLEXIBLE METALLIC TUBE-CONDUIT. C. Husman, Osnabruck, Germany, 607,932. Filed Nov. 20, 1897. Composed of several separate tubes laid up together like the strands of a rope.

JOINT FOR ELECTRIC CONDUCTORS. H. S. Patten, Montclair, and W. Maver, Jr., Jersey City, N. J., 608,412. Filed Dec. 31, 1897. Comprises the conductors and their insulating coverings with coup-

Digitized by Google

lings to which the ends of the conductors are soldered, the couplings having lapping ends with closely fitting surfaces, and a clamping device for holding them together.

Distribution:—

ELECTRICAL DISTRIBUTION. C. P. Steinmetz, Schenectady, N. Y., 608,307. Filed July 14, 1894. Comprises means for obtaining polyphase currents by interlocking a number of sources of alternating electromotive forces in such a manner that a desired difference of phase is maintained between the different machines, which difference of phase is stable.

SYSTEM OF ELECTRICAL DISTRIBUTION. C. P. Steinmetz, Schenectady, N. Y., 608,308. Filed July 14, 1894. Similar to above.

Dynamos and Motors:

ALTERNATING-CURRENT INDUCTION MOTOR. C. S. Bradley, Avon, N. Y., 608,249. Filed Oct. 22, 1895. Is provided with two independent field magnets wound to develop rotary magnetic fields, and two armatures of relatively high and low resistance co-operating with the fields.

ARMATURE FOR DYNAMO ELECTRIC MACHINES. E. H. Anderson and D. P. Thomson, Schenectady, N. Y., 608,277. Filed Jan. 8, 1898. Embodies a toothed armature-core, and openings in the core between the teeth and the main body of the core for limiting the cross-section of iron at that point.

COMMUTATOR. W. B. Potter, Schenectady, N. Y., 608,299. Filed April 27, 1898. Comprises a commutator segment, having a substantially straight side which forms the face side of the commutator when assembled, a lead slot, a groove into which the slot extends, and a securing lug.

Electro-Therapeutics:—

GALVANIC BATH. C. E. Schnee, Carlsbad, Austria-Hungary, 608,228. Filed Sept. 14, 1897. Means for directly introducing medicaments into the tissues of the human body by means of hand and foot baths or arm and knee baths.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. C. A. Pfluger, Chicago, Ill., 608,269. Filed Aug. 7, 1895. Comprises a fixed box with current controlling devices therein, tubes downwardly projecting therefrom and carrying each one conductor, and means associated with such fixed box and adapted to engage the carbon-rod tube of the lamp so as to hold it in position.

ELECTRIC HEADLIGHT LAMP. H. P. Wellman, Ashland, Ky., 608,497. Filed Dec. 10, 1897. Employs a parabolic reflector secured to the upright bar of the lamp frame, a translucent casing projecting through the reflector, supports therefor outside of the reflector, closures over the ends of the casing, and carbons secured to the inner ends of the rods.

Miscellaneous:—

IGNITER FOR GAS ENGINES. R. B. Hain, Grand Rapids, Mich., 607,992. Filed April 8, 1896. Details of construction.

RECIPROCATING ELECTRIC DRILL. H. Casler, Canastota, N. Y., 608,175. Filed March 18, 1898. Employs energizing coils having magnetic core within the same, a casing for the coils composed of an exterior shell, heads and an interior lining-tube all of iron or steel, and united by water-tight joints.

METHOD OF MANUFACTURING PRINTING BLOCKS IN COPPER, NICKEL, ETC. L. Boudreaux, Paris, France, 608,248. Filed July 15, 1896. Consists in applying a solvent to the surface of a plastic block, sprinkling its surface while in a soft state with metallic powder, removing superfluous powder when dry, and pressing the metallized block upon the etching to be reproduced.

SYSTEM FOR HEATING BY ELECTRICITY. J. F. McElroy, Albany, N. Y., 608,211. Filed Nov. 16, 1892. Consists of a plurality of heaters, each made up of a multiplicity of heater-sections, each of the heater sections arranged to be connected up in separate circuits, with means for varying the connections.

ELECTROLYTIC APPARATUS. J. G. A. Rhodin, Eccles, England, 608,300. Filed Aug. 11, 1897. Designed for the electrolysis of salts and employs an outer vessel of iron and an inner vessel of earthenware.

ELECTRO-MECHANICAL LOCK. H. G. Carleton, New York, 608,319. Filed Sept. 9, 1897. Details of construction.

ELECTRIC COMBINATION LOCK. H. G. Carleton, New York, 608,320. Filed April 4, 1898. Details of construction.

ELECTRIC LOCK. H. G. Carleton, New York, 608,321. Filed May 24, 1898. Details of construction.

AUTOMATIC SWITCH FOR REGULATING ELECTRIC AIR COMPRESSIONS. M. Moseley & Funck, Rochester, N. Y., 608,340. Filed Nov. 15, 1897. Combines an electric motor and compression pump with an automatic switch for controlling the motor-circuit, consisting of two communicating cylinders provided with pistons, suitable insulated contacts, one of which is movable, and operated by the movement of one piston produced by the admission of air to its cylinder by the movement of the other piston.

ELECTRIC HEATER. J. F. McElroy, Albany, N. Y., 608,343. Filed April 6, 1895. Comprises a central core piece carrying radial arms at either end, an encircling spring placed about the arms, insulating bars placed upon the encircling springs and extending longitudinally parallel with the core piece, a resistance wound upon the insulating bars and straining the encircling springs against the tension of the wire.

Railways and Appliances:—

ELECTRICAL RAIL BOND AND METHOD OF SECURING SAME IN PLACE. W. R. Cock, Plainfield, N. J., 608,178. Filed Dec. 7, 1897. Employs bond terminals which may be formed with or secured to the bond proper, and are formed, with a slight conical contour, so that they can be driven into a perforation in the rail and a comparatively tight joint formed between the rail and terminal.

ELECTRIC BOND FOR RAILWAY RAILS. S. H. Harrington, New York, 608,258. Filed Dec. 10, 1896. Comprises a bond ferrule adapted to enter and fit in a rail perforation combined with a bond-body passing through and movable in the ferrule, the bond-body having its extreme end slotted and a wedge arranged to lie in the slot and spread the end of the bond-body.

TROLLEY. F. E. Case, Schenectady, N. Y., 608,261. Filed June 30, 1897. Comprises a base, a combined lifting and buffer spring extending in one direction only from the base, and a pole-socket pivoted to the base at a point below the centre line of the spring.

SYSTEM OF TRAIN CONTROL. F. W. Rice, Jr., Schenectady, N. Y., 608,301. Filed Dec. 31, 1897. Means by which motor cars equipped so as to run and be controlled independently may likewise be readily controlled from a single point when joined in a train.

SYSTEM OF TRAIN CONTROL. E. W. Rice, Jr., Schenectady, N. Y., 608,302. Filed March 26, 1898. Similar to above.

Regulation:—

REGULATING DYNAMO ELECTRIC MACHINES. C. P. Steinmetz, Schenectady, N. Y., 608,309. Filed April 23, 1898. A method of extending the stable working range of dynamo electric machines, which consists in artificially increasing the reluctance of the magnetic circuit at a predetermined flux.

Switches, Cut-Outs Rheostats, Etc.:—

INSULATING CASTER AND ELECTRIC SWITCH COMBINED. A. W. Slayton, Tecumseh, Mich., 608,234. Filed May 18, 1898. Comprises a wheel made of glass combined with a metallic contact-arm pivotally secured to its metallic frame and adapted to form an electric connection with the floor.

Telegraphs:—

TELEGRAPHIC TRANSMITTING AND RECEIVING APPARATUS. B. Hoffman, Paris, France, 608,333. Filed May 5, 1897. Printing telegraph system. Details of construction.

RAPID TELEGRAPHIC TRANSMISSION ON CABLE LINES. C. L. Davies, London, England, 608,389. Filed June 25, 1896. Details of construction.

Telephones:—

TELEPHONE TRANSMITTER ARM AND ITS ATTACHMENT. W. J. Barr, Ashtabula, Ohio, 608,504. Filed Oct. 30, 1897. Comprises a base for a transmitter-arm having a slotted apex or open mouth, and provided with trunnions for the arm which are arranged interiorly and oppositely in the mouth and have enlarged heads or circumferential flanges.

TRADE NOTES AND NOVELTIES

The Canton Steel Roofing Company.

IT is a mistake to suppose from the name "roofing company" that the goods manufactured by this extensive establishment are confined wholly to roofing materials. It is true that this class of goods comprises a very large part of the output, but the products are designed for every use in which architectural effects are sought and for which sheet metal goods are adapted. These uses are many and are coming to be recognized as very desirable, as they have the advantage of cheapness and durability, also being proof against fire and free from dust and vermin, while a very important factor and one that appeals strongly to builders is the immunity of metal construction from lightning stroke, it being stated that there is no record of such buildings ever having been damaged from electric atmospheric

ONE OF THE PRODUCTS OF THE CANTON STEEL ROOFING COMPANY.

discharges. In an especial manner does this material lend itself to the requirements of car houses and power stations, the latter both for street railway and electric lighting purposes, and in these may be included not only the exterior but for the interior finish of the executive offices, and waiting rooms for employees and patrons. A list of the products of the above concern embraces roofing, made from either painted or galvanized plate, and includes plain sheetings, put on with different types of seams, crimped edge, beaded and corrugated as well as imitations of cluster slate, cluster shingles, and steel shingles of different patterns, including the Cushman, Eastlake, and Gothic tile. Included in the roofing materials are cresting block as well as skylights and ventilators, dormer windows, hip caps, tower ornaments, chimney tops, and last but not least, weather vanes and finials.

The above designs are classed as roofing, but the fronts,

Digitized by Google

which may be either of galvanized or copper plate, include imitations of weather board, pressed brick, and shingle siding, rock faced brick and rock faced stone of either uniform or rambling design, corner finish; pilasters, to which may be added rock faced window and door caps, as well as sills, also bay windows and all designs of cornice with fireproof blinds, either plain or corrugated. There may also be included in the external finish eave troughs, gutters and conductor pipes, either round, corrugated or square expanded, together with cut off joints and fastening accessories. The making of cornice is a large industry by itself, for metal cornices are adapted to all classes of buildings other than those built of metal, and the designing of these requires a high order of architectural talent, a claim which the output from this department has long sustained. Allied to the cornice are the zinc ornaments of which the works produce an almost endless variety.

Material for interior finish includes the ceiling, side wall and wainscoting. Sheet metal is especially adapted for this purpose, as it lends itself readily to the molding process, is preferable to other material because more beautiful, requires no repairs, and will not crack, warp, fall or burn. In this line of goods the company takes especial pride, not only in furnishing original and pleasing designs, but also in the superiority of finish, insuring that the plates will lap straight and regularly, and facilitating the labor of laying and decorating. Continuous styles for interior finish are made in strong relief and panel styles in three different depths.

The metallic buttons and ceiling nails are also provided for fastening plates to the sheeting or furring. The interior plates include beside the above, cornices, friezes, moldings, borders, dadoes, and ornamental centre pieces.

The output of the factory also includes among the specialties a large number of sheet metal boxes of peculiar designs and different sizes, for use by the customers in safe deposit vaults. These are painted and ornamented and provided with covers and locks. Among the specialties may also be included stove pipes which are made in five sizes. These are unriveted and are constructed with special hook seams which can be hooked or unhooked at pleasure, thus entirely doing away with the "profane annoyances" that have heretofore been a necessary accompaniment in "setting up stoves." These are packed in nests for shipping, insuring a low freight rate. Another unique product is a self-basting roasting pan made in different sizes of stamped metal.

The works of the company occupy a group of substantial two-story buildings, having a ground plan of 210 x 160 feet, and fronting on Tuscarawas street. The tool equipment is especially fine, and is operated by a 40 h. p. engine. There is also a generator for electric lighting purposes. Among the special tools may be noted heavy multiple toggle presses for corrugating and beading sheet metal; the press process being preferred to the rolled for the reason that the sheets are not as likely to buckle and are left in better shape for lapping and seaming.

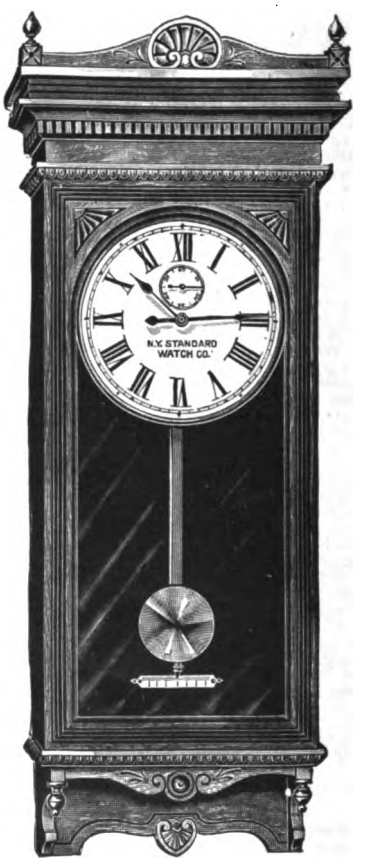
There are several large drop hammers for stamping panels and for making zinc ornaments, and in these the lower dies are usually made of cast iron, while the upper dies are cast from zinc and combined with the heavy cast iron hammer heads, deliver a very powerful blow. Designs are originated in the draughting room, and they are then wrought out in relief in clay or putty, when from these, plaster of paris patterns are made, numbered and stored for future use. From the plaster of paris patterns the working dies are cast, and these when broken or worn, are re-melted. Band saws and shears operate as auxiliaries to the drop hammers, and on these the sheets are re-trimmed, and in the case of the saw, a number of sheets are faced at one time. The sheets designed for plain roofing after being painted are united in 50-feet lengths by a peculiar interlocking cross seam, and for this work special machinery is provided. On one machine the ends of the plates are folded, then slid together, and as the seam passes under a press in the process of rolling up the metal, the seam receives a heavy blow from a die which closes it very tight. A number of paint grinding machines are provided, in which the metallic oxides are ground in linseed oil. There is also a machine for mechanically applying the paint to the sheet. This is done very rapidly and evenly. The machines for rolling and beading the eave troughs, and for corrugating the conductor pipes are original and interesting, doing the work very rapidly. The cornice and skylight departments are also equipped with numerous labor-saving devices. On the design for skylights the company prides itself. These are so constructed that the condensation from the glass is carried by gutters in the sash bars direct into the curb and discharged through weep holes on to the roof.

Because of ample facilities and attention to new and approved styles with special attention to quality, design and workmanship, the company have secured a large patronage for their various lines of goods, and their customers are from all parts of the globe.

The affairs of the company are conducted by the president, W. W. Clark; J. A. Shanafelt, secretary and treasurer, and T. C. Belding, superintendent.

Standard Electric Clocks.

THE New York Standard Watch Co., 11 John street, New York, have, after years of careful experimenting, succeeded in perfecting an electric clock movement that is said to overcome all the difficulties existing in the past. The ordinary sealed dry cells, as used for door bells, etc., furnish motive power to the clocks. They are concealed within the clock case, and when exhausted after a number of years may be renewed at the small expense of about 25 cents. The movements run equally well with weak as with strong batteries, automatically compensating for fluctuations in strength of current. They are regulated in the usual way, by raising or lowering pendulums to increase or decrease rate. One of these clocks, illustrated herewith, gives but a faint idea of the beauty of design and finish of the case. The movement of the clocks is extremely simple, consisting of an electro-magnet, and its armature so arranged as to give occasional impulses to the pendulum whenever an automatic switch closes the battery circuit. These impulses do not occur at even intervals, but their frequency varies with variation in the strength of the current. Therein is claimed to lie the secret of the company's successful adoption of electricity for time keeping. The clocks are thoroughly adapted for use in stores, offices, factories, schools, public buildings and railroads.



STANDARD ELECTRIC CLOCK.

Digitized by Google

Penn Electric & Manufacturing Company.

AS an example vindicating the law of demand and supply, this company has come into existence. It is noticeable that when there is a demand on the part of any considerable number of people for a labor saving or money saving device, or for higher efficiency in machines already on the market, somewhere, and usually from some unknown quarter, just the thing that is required comes forth, so in noting the products of this firm, we find some things that are new, and others that are simplified, or perfected forms of older types, but which seem to be just what the conditions require. These products embrace both electrical and mechanical specialties. The former include switches having capacities varying from 15 amperes up to 5,000 amperes; also switchboards made from either marble or slate, with all necessary connections. One of these consists of a new and patented design, known as a combined switch and distributing board, by means of which all the lights on any floor can be cut out, or all in the building by a single throw of the lever, in case at any time it is found necessary to protect the wiring from a threatened heavy current, either from lightning or crossing of wires. The wiring of these boards is very simple, and provision is made so that the connections are invisible. This is accomplished by providing a hollow binding post, or one that has been tapped into from the under side, so that the wires are inserted and when the cap is adjustea it comes in contact with the core and the wire, making a very neat job. All the binding posts and all connecting parts are cut from solid bars, no cast metal being employed. Other electrical appliances include telephone parts, with the exception of coils and bells, also an adjustable or expanding wire guard for protecting incandescent light globes. This guard, in place, clasps the globe all around, but is so designed that it parts at the base, so it can be unfolded to a flat circle, and when so unfolded the globe can be readily removed and renewed, when the guard is again closed in place. These guards are also made double, so that the outer one may be expanded and serve to carry a lamp shade, while the other protects the globe.

Among new mechanical devices, and one for which the company finds a great demand, is an adjustable door lock, by means of which a door may be fastened open at any angle, and still locked in position from the inside. This lock consists of a curved, perforated flat bar, so fitted to the jamb of the door that it plays freely in a locking device at the top of the door, the door being held in any position by a pin that is actuated by a chain hanging against the door on the inside. The most interesting mechanical device, however, which is made by this company, and which is in practical use in the shops, is an adjustable belt shifter, or rather a speed regulating device that avoids the shifting of belts. This device consists of a pair of expanding pulleys, one on the main shaft, the other on the jack shaft, or the one from which the machines are driven. This pulley when contracted has the form of an hour glass, but when closed looks like an ordinary pulley with a V-shaped groove. It is actuated by a shifting mechanism, which is operated by a vertical rod within easy reach of the operator. By turning this rod the pulleys may be simultaneously adjusted; one opened. and the other closed, thus giving any desired change of speed, without affecting the tension on the belt, a V-shaped belt being employed. These pulleys consist virtually of a pair of cone-shaped pulleys, with alternate triangular-shaped sections cut in the face of each so that they may dovetail together. One of each pair being fastened to the shaft, the other is made to approach or recede while running, and the speed graudated accordingly. There is also provided a means for tightening the belt by shifting the bearings of the secondary shaft. This device is said to be durable, and is not very expensive.

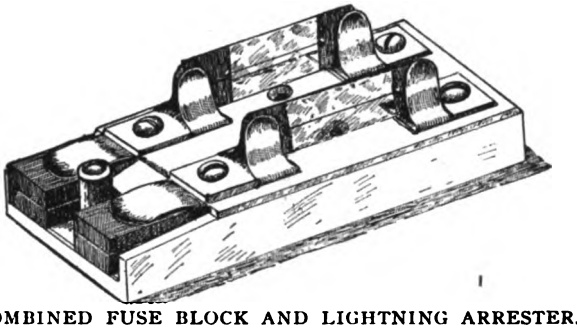
The company also make a specialty of chandelier fixtures for both electric and gas service, and they make many kinds of special machinery and tools, including patterns, models and perfected machines for inventors and engineers.

The shops are located on North avenue, Wilkinsburg, Pa., and the tool equipment of the factory is especially fine, consisting of the latest designs in turret headed lathes, milling machines, with a complement of ordinary metal working lathes, planers and drill presses, including one gang press. There are also tools for cutting and drilling marble and slate, with the necessary woodworking tools for pattern making, all of which are driven by steam power, generated on the premises. The business, however, has outgrown the capacity of the works, and the company contemplate moving to a more commodious building in the near future, or will erect for their own use extensive works that they may keep up with the demand.

The official staff of the company consists of the president, Mr. Fred. Hockensmith; secretary and treasurer, W. F. O'Neill, and D. M. Wagner, while the active management is in the hands of Mr. J. A. Wright, the originator of the company, and patentee of many of the specialties.

A New Combined Fuse Block and Lightning Arrester.

THE Telephone Department of the Electric Appliance Company, Chicago, has just put upon the market a combined fuse block and lightning arrester. It is an article of merit and will demand the attention of telephone exchange managers. It is four and one-quarter inches long by one and one-half inches wide. The illustration herewith gives a very fair idea of its appearance. Absolute protection is secured, it is claimed, from burn-outs from crosses caused by trolley and electric light lines breaking and falling across the telephone wires. It is also a positive lightning arrester and is practically indestructible. It requires no attention. The effect of a lightning discharge across the carbon blocks is that of producing a small amount of carbon dust. This can easily be removed by pulling out the carbon



COMBINED FUSE BLOCK AND LIGHTNING ARRESTER.

blocks and blowing out the dust, then replacing them, and the arrester is in working order again.

The fuse end of the arrester is connected to the wires running to the instrument to be protected, and the carbon arrester end is connected directly to the line wires.

The lightning arrester, part of this block, is constructed with two carbon blocks with perforated mica separating them. One block rests on the ground plate and the other is connected directly on the line, the idea being to produce an arrester on the air-gap principle. The perforations in the mica separator produce this result when the carbon blocks are placed in their proper position on the arrester. The fuse portion of the arrester can be furnished with either the Postal or Western Union type terminals, an ordinary two-inch copper or foil terminal fuse being used. The base is made of porcelain.

Montauk "Multiphase Cable" in Australia.

The popularity and success of American electrical goods abroad is shown again by the following item from the "Advertiser" of Williamstown, the port of Melbourne, Australia, of July 2d:

Yesterday afternoon a number of leading gentlemen attended Mr. E. H. Kirkby's manufactory, Nelson Place, to witness some startling effects in electric mechanism, either introduced into the colony from America by Mr. Kirkby, or the results of his own researches. The public of Williamstown may not be aware that Mr. Kirkby, in his own special line, is not only the leading mechanic in Melbourne, but he perhaps has no equal in Australia He does the electric alarm work for the Metropolitan Fire Brigade; has fitted up Government House, several of the large houses in Flinders Lane, the Princess Theatre, and his services have been sought to do similar important work in Sydney.

Mr. Kirkby yesterday astonished his visitors by the readiness of the various devices in his establishment to give fire alarms and ring bells and telephones upon the slightest provocation. There would be a fortune for an illusionist show in some of this mechanism he uses. One of these is so sensitive to heat that by

Digitized by Google

merely breathing upon it it will ring an alarm bell; but Mr. Kirkby explained that the temperature at which it worked could be regulated like the working of an alarm clock.

Mr. Kirkby has introduced the Montauk multiphase fire cable into the colony, and it was submitted to a highly satisfactory practical test for the first time in Australia yesterday. It is a most ingenious invention and Mr. Kirkby is so satisfied with it that he has taken the responsibility of recommending it to Mr. Stein, superintendent of the Metropolitan Fire Brigade, and will introduce it to the big mercantile houses in the city. The cable can be attached to an ordinary electric bell, to a telephone and to the fire alarm. The great and peculiar property possessed by this cable is that when it is ignited it will instantly ring a fire alarm on any premises where Mr. Kirkby's automatic fire alarm is connected with it. Mr. Kirkby is convinced that if this cable had been used in Melbourne recently the great fire at which damage to the amount of nearly one million sterling was done would have been avoided. Mr. Kirkby intends to give another demonstration in the city at an early date.

Simonds Manufacturing Company, Pittsburg.

THE principal products of this firm are pinions and gears for electric motor cars, and these, next to the motors, are the most important factors in electric car propulsion, for although the former are necessary to transmute the electric energy into power, they must needs deliver it to the axles and wheels through the medium of pinions and gears. As this service is particularly trying, the material, design and workmanship must needs be of a high order, and so exacting are the requirements of this service that only a few manufacturers, comparatively, find it possible to compete for this trade. This firm, however, because of long experience had in the business by one of the principals, and because of ample facilities, are turning out a first-class product, and are continually filling large orders, both for home consumption and from abroad. Two kinds of gears are manufactured, one from malleable iron, the other from steel casting, but in both cases a special mixture of material is specified, and the same grade has been maintained since its adoption in 1893. The castings are made in two parts, which are virtually split pulleys, with a smooth rim, and a single arm or spoke, which when fitted serves to bolt the two portions into a solid wheel about an axle. The machine work on the blanks consists first in planing the face of each spoke of a pair, including the hub, to provide for an exact fit, and this work is done on milling machines, in which the two halves are placed side by side, face up, and are dressed at the same time from milling tools on the same shaft, one cutting what is termed the male, the other the female face. The arms are then drilled, and the halves are bolted firmly and accurately together, when the hub is bored out, and next the gear teeth are cut. Two at a time are cut on milling machines, a very great degree of accuracy being required to prevent noise when running, and any undue strain from a lack or excess of metal in any one of the teeth. The malleable gears are more generally in favor with street railway managers than those of steel, and the company point with pride to a record of life of two years and a half made by one of their malleable gears on one of the street railway lines of Pittsburg. The pinions are cast in solid blanks and are then bored out and the gear teeth milled as described above.

The shop equipment is not devoted entirely to the manufacture of gears and pinions, but the company take orders for special work, and for gears and pulleys of every description. They also build the Murphy wheel grinding machines, which are having a large sale, and they also are building the large jacks and gears and other parts for the two dismantling devices to be employed in the new repair shops of the Consolidated Railway of Pittsburg, which were described recently in The Electrical Engineer in connection with that system. Another very interesting machine which has been designed and is being manufactured by the firm, is a glass bottle moulding machine, in which glass jars or bottles can be made at the rate of five a minute.

The works of the company are located at the corner of Liberty Ave. & Twenty-fifth Str., Pittsburg, Pa., and occupy a large two-story building with a fine heavy tool equipment, in which thirty to fifty men are employed. An elevator connects the two floors, and there are two traveling cranes for handling the large work. One of these has a span of 26 feet, and a run of 100 feet. The tools that are devoted exclusively to the manufacture of gears and pinions have a capacity for turning out twenty-five gears a day.

The management of the company's affairs is in the hands of Mr. Biddle Arthurs, president, and John Jackson, superintendent.

Leonhardt Wagon Manufacture Co., of Baltimore.

A railway emergency tower wagon for making trolley repairs is one of the special products of this firm, and quite a number of these wagons are in use by the local street railway companies, this type of wagon being the principal equipment of all the trouble stations of the principal railway systems of Baltimore. The particular feature of this wagon is a revolving base for the tower and the overhanging platform, as is shown by the accompanying illustration, by means of which repairs can be made without blocking the line. When in position for moving, the tower is lowered upon the body, but does not extend above the driver's head nor does it overhang beyond the body in the rear. To be placed in position, the platform is first raised up by hand, then by means of sprocket chains, actuated by a crank shaft and gears, the tower is raised to a perpendicular position, and then by means of a second shaft it is extended after the manner of an extension ladder. It is easily raised and lowered by one man, and is not top heavy. Perfect insulation is provided, and the body is equipped with large and roomy compartments for tools, including a cupboard under the driver's seat with doors on each side and a shallow box for tools, which constitutes the seat proper. The body is mounted on platform gear, and can be turned in its own length. A light tower wagon is also manufactured for use on roads having only light traffic. This has only tower ladders, without the revolving platform, and without operating mechanism. The ladders are raised by hand, and when up, the rear ladder is braced upon an elevated rod above the body upon which it rests by a forked foot, a pin being inserted below the rod to keep it always in safe position.

RAILWAY EMERGENCY TOWER WAGON IN POSITION FOR MOVING.

TOWER RAISED OVER PASSING CAR.

These wagons are well built, receiving the same care in construction as is given to the manufacture of the fire department wagons, including hose and "chief" wagons, of which the firm manufacture a large number, and well as wagons for all business purposes.

Digitized by Google

The shops occupy two brick buildings, one 25, the other 45 feet, by 225 feet deep, with a lumber yard of the same depth, 25 feet in width, between them. The manufacturers claim to have the best oak and hickory that is to be found in Maryland, as they are located in the neighborhood of the finest hard wood section of the country, and they are thus able to turn out first-class work at moderate prices.

Tests of Beacon Lamps.

A few weeks ago we had occasion to call attention to the high grade lamps turned out by the Beacon Lamp Company, of New Brunswick, N. J., noting how remarkably they retain their initial candle power and high efficiency after a run of 300 hours. The standard efficiency of the lamps is 3.5 watts per candle, and it is an actual fact that after 300 hours' burning the lamps give more light and use less current than when started, and show no blackening. These statements have been substantiated by tests made at the company's factory, and they now invite any trustworthy person to make photometric and other useful tests on their lamps and they will find that the company's claims are true. The following is one of a number of tests tried. Several Beacon and other lamps were burned side by side. After 200 hours' run half of the Beacon lamps were replaced by an entirely new set of the same make, and it could not be distinguished which lamps were the old and which the new ones. They have sent several batches of lamps to educational institutions for tests, and the results of these tests will soon be published by the company.

Activity of the Walker Co.

A contract awarded to the Walker Company, of Cleveland, for alternating current electric generators, was told of a few weeks ago. This order consisted of twenty 500 horse-power generators with other apparatus for the Union Carbide Company, of Chicago, and was in itself the largest single order for machinery of the alternating type ever placed. Mr. S. H. Short, vice-president of the Walker Company, has, during a recent trip to Chicago, secured a duplicate of this contract from the same company. The order as it stands comprises over 20,000 horse-power in generators and forms the largest contract for electric machinery of any kind ever awarded. The shops of the Walker Company are running night and day on existing orders and the recent large additions to the plant will be taxed to their utmost to put out the immense amount of work already in hand.

An Order from Australia.

The Government of Victoria, Australia, has placed an order with the General Electric Company for six Thomson recording wattmeters of 100 volts and varying capacities. These will be deposited in the Electrical Bureau of the Home Office of Victoria and will be used as the official standards by which all electricity meters used in the colony will be tested. In future no meters measuring electrical energy will be allowed to go into service in Victoria unless they agree with those just ordered and receive the final sanction of the Victoria Government.

Samson Batteries in the West.

The Central Electric Company, of Chicago, who are acting as Western distributors for the various types of Samson batteries, report a large and continuously increasing use of this product. The Samson battery has attained an enviable reputation as a product for use under conditions requiring the most exacting service. There has been quite recently introduced the new Samson "semi-dry battery," which has become very popular by reason of its desirable features. This battery has extra heavy zincs and large carbons contained in a porcelain jar and sealed. Its ampere output is very large, and as it is portable it is adapted for use under conditions where the former type of open batteries could not be used. The Central Electric Company are carrying large stocks of all Samson types and are prepared to make immediate shipment on all orders.

PINE BLUFF COTTON OIL CO., Pine Bluff, Ark., has recently ordered an engine for electrical purposes from the Ball Engine Co., Erie, Pa.

First Order From Our New Dependencies in the West Indies.

The Westinghouse Machine Company have already begun to reap some benefit from the recent brilliant successes of American arms in Cuba. They are to-day advised that their New York office has received the initial order for a complete steam plant, involving a 100-horse-power Westinghouse engine and Westinghouse generator, together with boiler, pump, piping, etc., this plant to be installed in Santiago de Cuba.

Warren-Medbery Company.

The new works of the Warren-Medbery Company, manufacturers of inductor alternators, Sandy Hill, N. Y., are now running to their utmost capacity, day and night, in order to fill the orders for their apparatus. Their business has increased over 100 per cent. within the last sixty days, the demand for inductor machines reaching far beyond their expectations. They have recently made a large addition to their works, and the new machinery is now being installed, when they hope soon to be able to meet all demands upon them, for alternators. They are also manufacturing a fine line of standard white marble switchboards, and a full line of the celebrated "Medbery" and "Standard" switches, so well and favorably known. The "Medbery" insulation and over-head equipment, for electric railways is now being manufactured by this company, who are prepared to furnish this high grade material promptly.

Fuel Economizer Sales.

The Fuel Economizer Co., of Matteawan, N. Y., find business excellent and improving. They report recent sales as follows: Milwaukee Electric Railroad, Milwaukee, Wis., 2,000 h. p.; Worcester Bleach and Dye Works, Worcester, Mass., 350 h. p.; Merchants' Cotton Co., St. Henri, P. Q., 600 h. p.; Excelsior Mills, 300 h. p.; Lehigh Valley Coal Co., Wilkesbarre, Pa., 2,000 h. p. (2 orders); Western Cold Storage Co., Chicago, Ill., 300 h. p.; Cheney Brothers, South Manchester, Conn., 2,000 h. p.; Blackstone Mills, Blackstone, Mass., 500 h. p.; La Belle Mill, Water and Power Co., Goldfield, Colo., 1,000 h. p.; Dominion Cotton Mills Co., Magog, P. Q., 1,000 h. p. (12th order); Frick Co., Waynesboro, Pa., 150 h. p.; D. M. Bare & Co., Roaring Springs, Pa., 600 h. p.; Rome Brass and Copper Co., Rome, N. Y., 350 h. p.

Frontier Iron Works, Detroit.

Among recent shipments of Frontier tandem gasoline engines by the Frontier Iron Works, Detroit, are: One 60 h. p. to Norway, Mich., for a village electric lighting plant of 600 lights; one 40 h. p. to Bay City, Mich.; one 40 h. p. to Ogdensburg, N. Y.; one 40 h. p. to Wichita Falls, and several 25 and 20 h. p. engines of the same type. The company claim for this engine a regulation equal to that of the steam engine, adapting it to electric lighting and similar duty at a decided economy of fuel and attendance.

ADVERTISERS' HINTS

THE PECKHAM TRUCK CO. call attention to their extensive line of trucks adapted to all conditions of service and all styles of car, both passenger and freight, and trucks also for switching engines.

TELEPHONE WOODWORK is the subject of the announcement of the Cabinet Mfg. Co.

THE WROUGHT IRON BRIDGE CO. advertises iron and steel bridges, buildings, roofs, turn tables, etc.

F. A. LA ROCHE & CO. specify the Ideal Circuit Breaker as the king of all instruments of this nature, at the same time announce a new circuit breaker, the Victor, which will shortly be placed on the market.

WILLIAM E. QUIMBY advertises screw steam pumps.

BEACON LAMP CO. guarantee their lamp to maintain initial candle power for over 300 hours.

"CHEAPER THAN COPPER" bids fair to be the trade-

Digitized by Google

mark of John A. Roebling's Sons Co. in connection with "Bimetallic Wire."

WHEELER REFLECTOR CO. offer their reflectors as the connecting link between sunset and sunrise.

WESTINGHOUSE ELECTRIC & MFG. CO. show illustrations of four different types of their engines.

WESTERN NOTES

F. & L. PUSH FLUSH SWITCH is one of the most successful of the Electric Appliance Company's smaller specialties. It is the smallest push switch on the market, the size of the face plate being only 1¾x3¼ inches. It also requires a very small opening in the wall, operates with a very slight pressure on the keys and has many other valuable features, not the least of which is the fact that it is sold at a price considerably below the market for a push flush switch.

THE CITY OF ELKHORN, WIS., has recently ordered a 135 h. p. compound condensing engine for its electric plant. The engine will be furnished by the Ball Engine Co., Erie, Pa.

MR. J. G. HICKCOX, secretary of the Cutler-Hammer Manufacturing Co., 70-82 West Jackson street, Chicago, says: "Our business has increased so rapidly in the past few months that we have been obliged to secure additional space which we are equipping with the latest machinery. With these improved facilities we expect to be able to take care of all orders in a prompt and efficient manner."

CARD ELECTRIC CO. Mr. S. N. Ford, receiver of the Card Electric Co., of Mansfield, Ill., reports with regard to their recent situation as follows: "The immediate cause of our embarrassment was too much work. We accumulated a large number of orders and found ourselves unable to put them through our factory fast enough to meet our obligations for material, and had to take action to protect ourselves and creditors. We expect to continue work without interruption."

CENTRAL ELECTRIC CO., of Chicago, is issuing a very attractive circular on various types of electrically heated cooking utensils and appliances, and will be pleased to send the same to anyone on application.

CEDAR RAPIDS, IA. As the result of an investigation by the City Council of prices in different parts of the country, a contract has been recommended with the Cedar Rapids Electric Light and Power Company for ten years at $75 per year per 2,000 c. p. arc light, 210 lamps being required. It was shown conclusively that this price was hard to beat.

NEW ENGLAND NOTES

PAGE ELECTRIC CO., of Worcester, Mass., has recently increased its capital stock to $5,000. It has bought out the business of the Worcester Central Electric Co., and has established itself at 24 Pearl street. The Page Co. was originally founded in 1885 and incorporated in 1897. It is doing a large amount of construction work, and is selling apparatus all over New England. Mr. J. P. Coghlin, who is well known in the trade, is now treasurer and manager of the concern, and is pushing things.

NEW ENGLAND SANITARY PRODUCT CO. are erecting at Old Harbor Point, Mass., near Boston, an absolutely fireproof building 120 feet wide and about 130 feet long. The building is two stories high, and is of skeleton steel framework style, consisting of steel columns built in the walls, carrying heavy steel floor beams and girders, and clear span roof trusses which support the roof. The structural steel work in this plant was designed and is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

MECHANIC FALLS, ME., has a prodigy in Henry E. Rowe, who at the mature age of seven is a good telegraph operator.

WORCESTER, MASS. The Page Electric Co. has absorbed the business of the Worcester Central Electric Co., and has moved to new and larger quarters at 24 Pearl street.

NEW YORK NOTES

DOVER, N. Y. The new manager of the Dover Electric Light Company is Mr. Eugene T. Wightman, from Middletown, N. Y., where he was the chief engineer of the Middletown-Goshen Traction Company. Prior to that he was with the Electric Street Railway Company in Danbury, Conn., and for ten years he was the superintendent of the electrical department of the Danbury-Bethel Gas and Electric Light Company.

MR. ROSSITER, president of the Brooklyn Heights Railroad, has proposed a trolley loop one mile around on the New York side of the bridge, to avoid the present congestion. It is the same old trouble. What is wanted is a few more bridges.

CONTENTS.

EDITORIALS:
The Detroit Municipal Lighting Plant 154
Peace with Honor 154
The Present Status of the Calcium Carbide Industry in Europe.... 155
Trolleys on the Brooklyn Bridge 155
TELEPHONY AND TELEGRAPHY:
The Central District and Printing Telegraph Co.—Bell Telephone Interests in Pittsburg (illustr.).....C. B. Fairchild. 145
Motor Generators for the Chicago Fire Alarm System (illustr.).... 146
ELECTRIC TRANSPORTATION:
The American Electric Motor Vehicles (illustr.) 147
A Plea for the Introduction of Goods' Traffic on Our Suburban Trolleys (illustr.) .....W. T. Bonner. 148
Large Railway Storage Battery Plants for Chicago Elevated Railroads 151
Power Consumption in Electric Railroading—I. (illustr.)..... S. T. Dodd. 152
Electric Canal Traction in Europe 152
ELECTRIC LIGHTING:
The 1898 Report of the Detroit Municipal Electric Light Plant (illustr.) 153
NEWS AND NOTES:
The First Regiment, U. S. Volunteer Engineer Corps (illustr.).... 156
Extension of Electric Traffic at the New York and Brooklyn Bridge Terminus.—Electrical Activity in Chicago and Vicinity..... 158
MECHANICAL:
Boiler Test Meters.—Worthington Steam Accumulator 158
POWER TRANSMISSION:
Use of Alternate Current Motors in a Bleaching and Dyeing Establishment, Providence, R. I. (illustr.)..... 159
ELECTRO-CHEMISTRY
Commercial Development of Electro-Chemistry in England..... 159
SOCIETY AND CLUB NOTES:
Fire and Police Superintendents in Convention.—The American Street Railway Association.—The Coming Mechanics' Fair in Boston 160
THE STOCK MARKET:
Further Trade Improvements..... 160
EDUCATIONAL:
McGill University.—The W. C. McDonald Chair of Electrical Engineering 161
PERSONAL:
Mr. Seaton M. Scott.—Mr. Martin J. Insull.—Mr. E. L. Brayton.. 161
OBITUARY:
Dr. G. O. Colton.—Mr. J. J. Schoenleber.—Mr. Geo. B. Richmond. 161
LITERATURE:
Quantitative Chemical Analysis by Electrolysis.—Maver on Underground Work 161
LETTERS TO THE EDITOR:
Preventing Collisions at Sea .....Hermann Herberts. 162
LEGAL NOTES:
Suit to Stop General Electric Reorganization.—The Value of a Child.—A Trolley Accident Case 162
REPORTS OF COMPANIES:
Westinghouse Retirement of Floated and Bonded Debt.—Pittsburg United Traction Co..... 162
INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Aug. 2, 1898.. 162
TRADE NOTES AND NOVELTIES:
The Canton Steel Roofing Co. (illustr.) 163
Standard Electric Clocks (illustr.) 164
Penn Electric and Mfg. Co.—A New Combined Fuse Block and Lightning Arrester (illustr.).—Montauk "Multiphase Cable" in Australia 165
Simonds Mfg. Co.—Leonhardt Wagon Manufacture Co., of Baltimore (illustr.) 166
Tests of Beacon Lamps.—Activity of the Walker Co.—An Order from Australia.—Samson Batteries in the West.—First Order from Our New Dependencies in the West Indies.—Warren-Medbery Co.—Fuel Economizer Sales.—Frontier Iron Works, Detroit.—Advertisers' Hints 167
Western Notes.—New England Notes—New York Notes..... 168

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

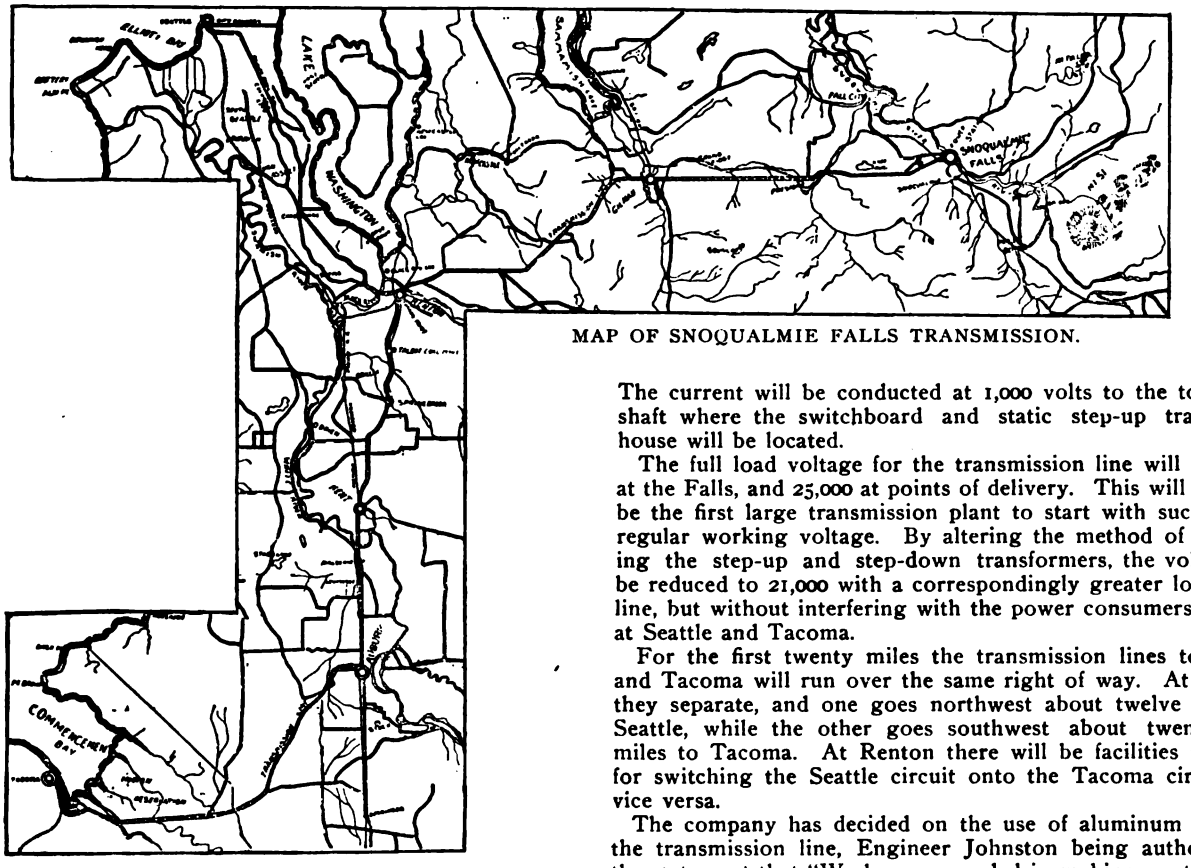
Vol. XXVI. AUGUST 25, 1898. No. 538.

The Snoqualmie-Seattle-Tacoma Transmission With Aluminum Live Wire.

SECOND to none in importance among the water power transmission projects that are being carried out this year is the undertaking which will bring the water power of the Snoqualmie Falls to the cities of Seattle and Tacoma, Wash. It is expected that within a few months this company will be able to furnish 4,000 kilowatts at Seattle, and 2,000 kilowatts at Tacoma, the latter city being the most distant from the falls. The company is backed by Chicago capital and brains, William T. Baker, formerly president of the Chicago Board of Trade, being the financial backer, and Thomas T. Johnston, a prominent Chicago engineer, consulting engineer of the drainage canal, and president of the Western Society of Engineers, engineer of the new project, under whose direction the work has been planned and is being carried out. Chas. H. Baker, of Seattle, is president and manager of the company, while J. J. Reynolds, formerly chief engineer of the Chicago Terminal Railway, is superintendent of construction.

The falls of the Snoqualmie River are about twenty-four miles (air line) east of Seattle, and thirty-four miles (air line) northeast of Tacoma. The Snoqualmie is fed by the western slopes of the Cascade range and drains about 400 square miles. The falls have a drop of 268 feet. Readers of The Electrical Engineer will remember the picture published of the falls in these pages, four or five years ago.

Construction work began early the past spring. Three hundred feet up the river from the falls a dam will be built along a ledge of rock at that point. The dam will be 450 feet long, fifteen feet wide at the base, eight feet wide at the top, and of solid concrete. In the centre of the dam will be a bear trap dam for the escape of flood water. The water intake will be a 20-foot channel extending 60 feet up and down stream. From the intake the water will be piped through two 7-foot steel pipes down a vertical shaft cut down 250 feet in the solid rock. The shaft is being cut 25 by 8 feet. The water wheels and generators will be in a cave at the foot of the shaft, 200 feet long, 50 feet wide and 25 feet high. A tunnel is being driven in horizontally from below the falls to serve as a tail race. This tail race will extend from the wheels, 660 feet to an outlet in the face of the cliff below the falls. In order to clear the river for the building of the dam, the current will be turned through the shaft and tail race as soon as they are finished and allowed to run there until the dam is finished. In other words, Snoqualmie Falls will go dry for a time. The rock taken from the shaft is being crushed for use in the concrete dam, The dam being completed, the current will again be turned into the river, and Snoqualmie Falls will again exist. Then the two steel pipes and an elevator will be put in the shaft, and the water wheels and dynamos placed in the cave at the bottom. There will be four 1,500 kilowatt, 1,000 volt Westinghouse three-phase generators with a frequency of 7,200 alternations per minute. They will be direct connected to water wheels running 300 revolutions per minute. These generators are to be of the revolving armature type.



MAP OF SNOQUALMIE FALLS TRANSMISSION.

The current will be conducted at 1,000 volts to the top of the shaft where the switchboard and static step-up transformer house will be located.

The full load voltage for the transmission line will be 29,000 at the Falls, and 25,000 at points of delivery. This will probably be the first large transmission plant to start with such a high regular working voltage. By altering the method of connecting the step-up and step-down transformers, the voltage can be reduced to 21,000 with a correspondingly greater loss in the line, but without interfering with the power consumers' voltage at Seattle and Tacoma.

For the first twenty miles the transmission lines to Seattle and Tacoma will run over the same right of way. At Renton, they separate, and one goes northwest about twelve miles to Seattle, while the other goes southwest about twenty-seven miles to Tacoma. At Renton there will be facilities provided for switching the Seattle circuit onto the Tacoma circuit and vice versa.

The company has decided on the use of aluminum wire for the transmission line, Engineer Johnston being authority for the statement that "We have succeeded in making contracts for a supply of aluminum wire at prices that make it cheaper than copper for our purpose. The metal we are to use will be of remarkably pure quality, being guaranteed to contain 99.30 per cent. of aluminum, and not more than 0.25 per cent. of iron and 0.30 per cent. of silicon. This will be alloyed with 1.50 per cent. of pure lake copper. We shall use about 150,000 pounds of it."

This is the first large transmission to use aluminum, and marks an important step in electrical engineering, for while aluminum has been talked of for some time for this purpose, price or some other factor seems to have stood in the way of its practical use to any extent over long distances.

Digitized by Google

The pole line is for the most part on the country roads, but in some cases a private right of way has been secured for a small sum. Large trees liable to fall on the line have all been cleared away. The poles were all purchased in the surrounding country. Wooden pins and cross arms will be used. Two circuits of three No. 2 aluminum wires each will run to Seattle, and two circuits of three No. 3 aluminum wires each will run to Tacoma. Thus each pole line will carry six wires. There will be two cross arms on a pole and the pins will be arranged so as to bring the three wires of each circuit at the corner of an equilateral triangle. Triple petticoated porcelain insulators known as the Redlands type because used on the Redlands, Cal., transmission, will support the aluminum conductors. Poles will be set about 120 feet apart.

Like other companies developing large water powers for electric transmission purposes, this company will aim to do a wholesale rather than a retail power selling business, and will sell mainly to existing companies in the light, power and railway business. Already a large output has been contracted for. Coal in Seattle and Tacoma is cheap, being about the same as in Pittsburg, but it is of such poor quality as to be of only about half the calorific value of Pittsburg coal.

The flow of the Snoqualmie River is such that 30,000 horse power will be available at extreme low water, but a system of catching flood water might increase this many times, should it ever be demanded by the needs of the two cities. About 12,000 horse power is to be made immediately available at the falls, according to the present work being carried out.

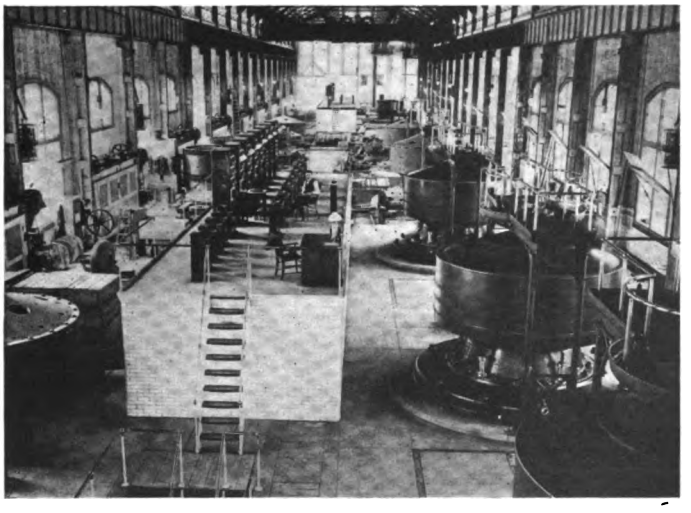
The Enlargement of the Niagara Power House.

BY O. E. DUNLAP.

FIVE of the great 5,000 h. p. dynamos now stand in a row on the floor of the power house of the Niagara Falls Power Company, and the sixth one is being built in front of the new switchboard. The original switchboard is designed to handle the current from only five of the machines. The new switchboard structure stands at the far end of the dynamo room, and is similar in design to the first structure. Each board will control five of the dynamos to be placed. The illustration well portrays the present appearance of this famous station.

Over in the transformer room there are eight of the transformers in position, all of the same pattern.

A short time ago the Buffalo Railway Company installed another pair of rotary converters to handle Niagara current.



EXTENSION OF THE NIAGARA POWER HOUSE.

Their design is similar to the machines first placed. The Buffalo Railway Company are now taking 2,000 horse power of the Niagara current.

That there is a growing demand for Niagara power in Buffalo is evident from the fact that the Cataract Power and Conduit Company are building a new transformer station at No. 2290 Niagara street in that city. The building will be of brick, and cost $2,500. It is understood that a large malt house that is being built at Niagara and Albany streets, Buffalo, will receive the first power from this station. This malt house will have a frontage of 340 feet on Albany street and 220 on Niagara street. It will have a capacity of 300,000 bushels. There will be thirty

STEP-UP TRANSFORMER BANKS, NIAGARA POWER HOUSE.

pneumatic tubes, each with a capacity of 600 bushels. A kiln 60 feet square and 180 feet high will also be built in connection with the malt house.

TELEPHONY AND TELEGRAPHY

Individual Motors for Coil Winding in a Telephone Factory.

THE American Electric Telephone Company, in its factory at Chicago, one of the largest independent telephone concerns in the United States, has adopted a subdivision of electric power units for winding coils that carries electric shop transmission and subdivision to an extreme rarely found. The interest in this transmission lies, not in the simple fact that electricity and the electric motor are the means employed for delivering power to the different machines, but in the smallness of the motors and the fineness of the subdivision.

In the department of the factory where the various coils are wound, are a large number of small motors—one for each operator employed in winding. Thus, instead of having a winding lathe for each operator and connecting the lathe with a line shaft, each operator has a small motor and the core to be wound is put directly on the shaft of the motor. The company made its own motors for this purpose. They are of an entirely enclosed type to avoid all danger of accident or injury to the motor as the operators are working over the motors. The motor is, of course, put on the bench in front of each operator. Just at the edge of the bench, at the operator's right, is a rack for holding the supply wire spool. The core to be wound is put on the right hand end of the motor shaft and the wire is run directly from the spool to the core through the operator's right hand, which acts as a guide and a brake to keep the wire tight in winding. At the left hand end of the motor shaft is a disc about four inches in diameter for a hand wheel by which the motor shaft can be held or turned by the operator when putting on or taking off a core, or when starting or ending a coil. Just under the bench at the operator's left hand is a rheostat protected by perforated sheet brass. While guiding the wire with the right hand, the operator turns on current with the left, and if the operator is skilful, a very high speed is attained in winding. Nowhere is the convenience and flexibility of the electric motor better shown than in this work. Instead being confined to a table equipped with line shaft underneath and cone clutches, the operators can be scattered

Digitized by Google

around where light is good and where space can be utilized to best advantage. The speed is more perfectly under control than with a common line shaft, and consequently more and better work can be done. Girls are employed at this work.

This is a good example of the extremes to which the subdivision of electric motive power in shop transmission is being carried these days, and shows that mere economy of power is by no means the chief object to be gained by electric shop transmission in many cases. Convenience of location, utilization of waste room and perfection of individual machine control may be far more important factors in the output of a factory, shop or printing office than simple cost of power alone.

Timing Calls in Telephone Exchanges.

BY HENRY ABBOTT.

IT is not proposed in this paper to discuss such interesting questions connected with the handling of a telephone toll department as the length of the initial period or the minimum period upon which a charge should be made; the amount of grace which should be allowed, or the number of seconds a patron may be permitted to talk beyond the first period before he is charged with the second; the question whether all time beyond the first period should be prorated; the number of trunk lines a single operator may handle profitably, etc.; but to consider the relative merits of the different methods and appliances employed in timing calls in telephone exchanges in the United States.

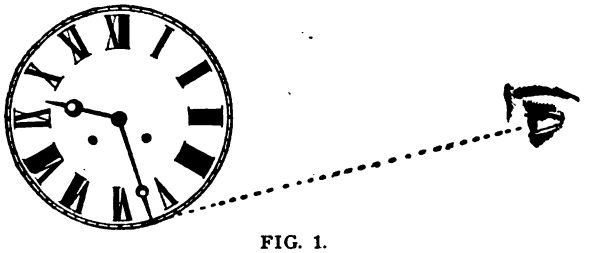


FIG. 1.

It will be apparent, however, that the success of any method of timing is dependent in a measure upon the number of connections an operator is obliged to make. It is obviously good business policy in the management to require operators to handle as many trunks as they can efficiently and profitably. Local conditions and the character of the business of course affect the number of messages as well as the number of trunk lines which a single operator can handle and supervise closely. Thus, lines connecting cities or large towns are kept "hot" with messages during the rush hours of the day, while lines radiating to the suburbs or connecting sparsely settled communities are less often used, and of this latter class an operator may efficiently handle more trunks than of the former. It is, however, my belief, based upon observation, that there are more telephone exchanges in which the mistake is made of overloading toll operators beyond the point of giving efficient service and the point where it is profitable, than those in which the error is upon the other side.

One manager expressed the situation fully in saying to me,

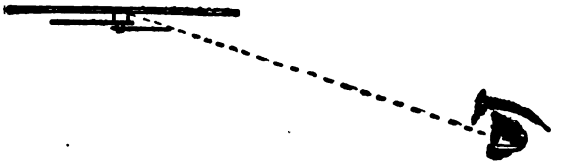


FIG. 1a.

"our operators are too busy to employ any other method of timing messages than that of writing it down with a pencil." This manager clearly did not understand the situation, was doubtless too busy to investigate or have it investigated for him. He could not know how much revenue his company lost in toll charges because the operator read the time wrong on the clock dial while she was trying to talk to and make connections for two other patrons, or having read it right, wrote it down wrong, or made an error in subtracting the commencing time from the finishing and got the elapsed time wrong; or, as is most often the case, waited until she had a spare moment, and then having forgotten the actual time, was compelled to estimate it. In such case, the operator being only human, having a wholesome fear of discipline, and knowing full well that only the patron who is overcharged ever makes a "kick," gives the patron the benefit of the doubt in her estimate.

I shall consider as means employed to time toll messages, pointing out the advantages and disadvantages of each, the following: 1st. Clocks having visible dial, hour and minute hands. 2d. Clocks having visible dial, hour, minute and second hands. 3d. Clocks showing figures representing the hour and minute through openings in the face. 4th. Time stamps. 5th. Stop watches. 6th. The calculagraph.

The clock having hour and minute hands only, undoubtedly possesses the advantage of being the cheapest device which could be employed. I have seen in use in a number of exchanges, clocks for timing toll messages (upon the accuracy of which the entire revenue of the department depends) which could be bought at retail for fifty cents, and which purchased in quantity doubtless cost the companies using them very much less. There are, of course, a great variety of clocks available for this purpose. Improved machinery and modern methods have enabled the American clock manufacturers to produce and sell for a few dollars a really excellent time keeper; and in view of the possibilities of the clock market, it would appear that the spirit of economy has been pushed to the point of absurdity when it employs for the purpose of determining the value of a service amounting to perhaps several hundred dollars per day, the meanest and most poorly-constructed device which is entitled to the name of clock.

When clocks having hands or pointers are used for timing messages, one should be provided for each operator and should be placed directly in front of the operator, with the centre of dial in the line of vision. I have seldom seen them so used. It is more common to find one large clock hung high up on the wall used by the entire exchange, or to find one on each side of the room, or at the best, one of the smaller, cheaper variety placed between each two adjacent operators. A serious objection to so placing the clock is the fact that each operator will see the time differently at the same moment; moreover, each operator will see the time incorrectly at different periods and will read it both fast and slow during each half hour. For example, let us suppose that a clock having a six inch dial be placed upon the front of the switchboard midway between

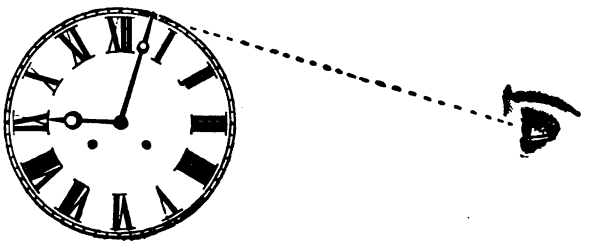


FIG. 2.

two operators, and at such height that it will be central on the line of vision. When the minute pointer is at the top of dial, the operator at the left, looking at the clock, will see under the point of minute hand and the hand will appear to her vision to coincide with the minute mark on the dial from one minute to one and a half minutes faster than the actual time indicated. This is due to the oblique view she gets of the clock face. At the same moment of time the operator at the right will see the time from one to one and a half minutes slow. See Figs. 1 and 1a. Again, when the minute pointer is at the bottom of the dial, the conditions being reversed, the left hand operator will see the time slower, and the right hand operator will see it faster, than the correct time indicated to a person looking directly toward the centre of the dial. See Fig. 2. When the minute pointer stands at either IX or III, both operators will see the time correctly. At all other points on the dial the error of vision is a constantly varying quantity, depending upon the angle of vision.

I recently persuaded the superintendent of one of the telephone companies to make a series of tests of the methods then in use in his exchanges for timing toll messages. The results obtained were a revelation and led to immediate preparation

Digitized by Google

for reform. It would be manifestly improper to mention names of corporations or individuals in a paper of this character; but I am permitted to state the conditions existing and some of the results obtained.

The test was made on a toll-board having six operators, each of whom handled the business of eight trunk lines extending to towns within a radius of thirty miles; the system of charging was for even periods of five minutes each, and thirty seconds grace was allowed before a charge for an additional period was made. The charge for each period on the lines covered by the test averaged thirty-five cents, clocks having minute and hour hands only being used, and placed between each two adjacent operators.

Inspectors were appointed to "listen in," and without the knowledge of the operators, made duplicate records of the elapsed time for each connection, using stop watches for this purpose. Four hundred connections were so tested, and the elapsed times obtained by listening in compared with the elapsed times written down on the toll checks by the operators.

The results were as follows, viz.: 13 per cent. of the connections were from five to ten minutes in length and 6¾ per cent. lasted more than ten minutes. 59½ per cent. varied less than one minute from the time obtained by listening in on connections; the other 40½ per cent., which were more than one minute out, were in every case timed in favor of the patron, i. e., they were not charged with proper overtime. As but seventy-nine of the four hundred connections were of such length to be subject to charge for not more than one period, only thirty-two of these charges were lost to the company, At thirty-five cents each, they, however, represented a net loss of $11.20 on the four hundred connections, or 6.6 per cent. of the total value of the business.

Had the other conditions been the same, but the charges based upon even periods of three minutes each instead of five, it is easy to figure that the net loss to the company due to these errors in timing would have been very largely increased. Or had the distance covered been greater or the tariff charges correspondingly higher, the loss in revenue would have been large enough to merit the attention of the busiest of managers.

Another test was made in an exchange where the conditions were similar to those above stated, and where the same style of clock was employed. In this case, however, the operators were warned that their work was being watched by inspectors, and were cautioned to be very careful to time their connections accurately. Three hundred connections were timed with the following results, viz.: 18.3 per cent. were five to ten minutes in length and 4.7 per cent. lasted more than ten minutes. The time obtained by listening in, when compared with the time written down by the operators, showed that 84 per cent. varied less than one minute each, the other 16 per cent. being over one minute wrong, and in every case, timed in favor of the patron. The three hundred connections represented a total of three hundred and fifty charges. Of this number ten charges were lost to the company because of inaccurate timing by the operators. Should this test be taken as an average showing of the business of this particular exchange, the results would indicate a net loss in revenue (figured upon the average daily receipts) equal to $11.62 per day.

The manager, however, expressed the opinion that it would be unfair to assume this to be the average, as the operators could with difficulty maintain this standard of efficiency, even though they knew they were being watched.

I have observed it to be the practice in some exchanges for the operator to write on the toll ticket, at the end of a conversation only, the elapsed time in minutes. In others, to write the time of day at the moment of connection and the elapsed time at the disconnection. In still other exchanges it is the practice to write the time of day both at connection and disconnection, a special clerk being charged with the duty of subtracting the one from the other, noting down the elapsed time, calculating and recording the charge. This latter system appears to possess advantages over the two others mentioned, in that it relieves the operator (especially in a busy exchange) of the mental strain required to perform such operations of subtraction and multiplication, and would reduce the errors resulting from such calculations to the minimum, though it would not remove the errors of vision, or those of memory, and would, moreover, be impracticable, except in a large exchange, because of the salary of the additional clerk.

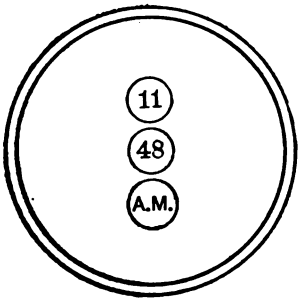


FIG. 3.

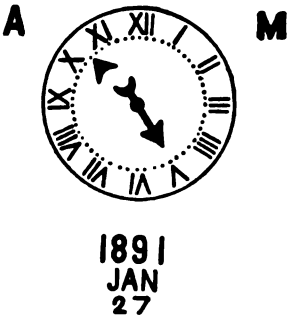


FIG. 4.

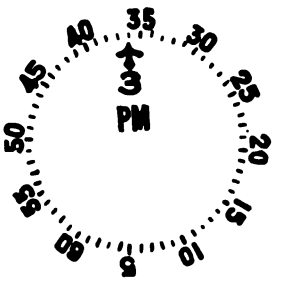


FIG. 5.

JAN 25 11 56 AM 1897

FIG. 6.

FIG. 10.

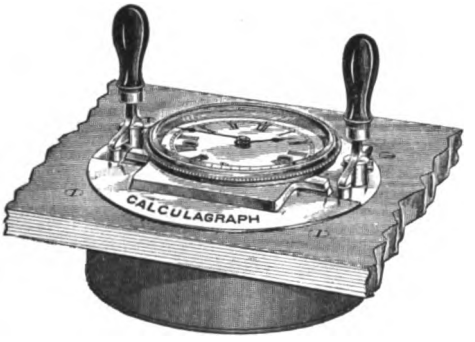


FIG. 12.

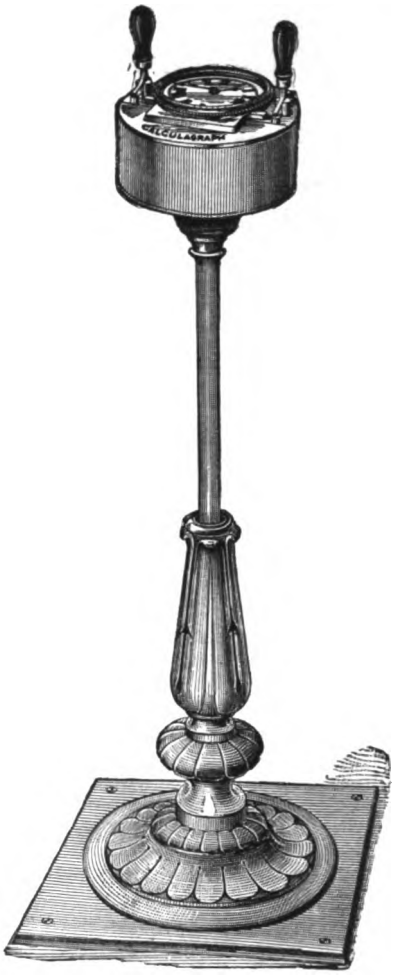


FIG. 11.

Digitized by Google

In the use of a clock having visible hour and minute hands only, it is most convenient for the operators to ignore all fractional parts of a minute and to record upon the toll checks even minutes only. If then a half minute be dropped from the actual time of connection and another half minute from the

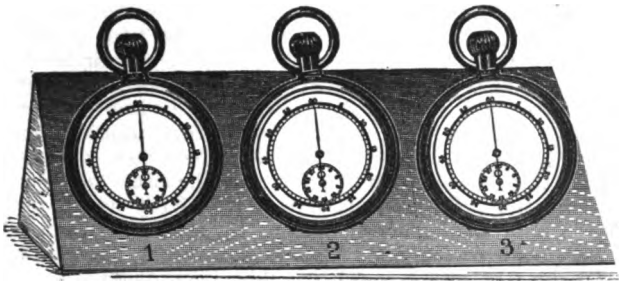


FIG. 7.

time of disconnection, the elapsed time shown upon the toll check will be a full minute less than the actual time of the conversation. It might be assumed that the recorded time by this practice is as likely to be too long as short and that while one patron would profit another would suffer, yet the net result in revenue to the company would average about right. In practice, however, this is not found to be the case. The same human frailty which permits operators in a telephone exchange to grow careless and inattentive to their duties will also prompt them, when compelled during a rush period to estimate the time, to make such estimate in a manner to avoid complaint from the patron, the result being that more than 90 per cent. of the errors which occur in timing toll messages are at the expense of the company.

It should not be concluded from these statements that employees in telephone exchanges are thought to be more careless

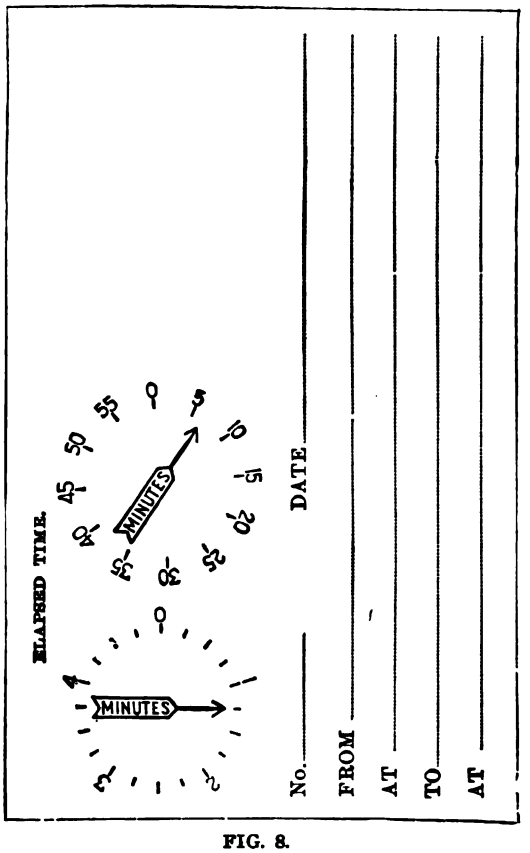


FIG. 8.

or more liable to errors than others—quite the contrary—it is believed that the high degree of efficiency known to exist in the telephone service in the United States could not be reached but by the employment of operators above the average of intelligence and devotion to duty. It is merely the purpose to emphasize the statement that no amount of discipline, however rigid, will entirely eliminate the errors due to imperfect human nature, which I shall call the personal errors.

2d. Clocks having visible hour, minute and second hands, when used for timing toll messages, permit recording fractional parts

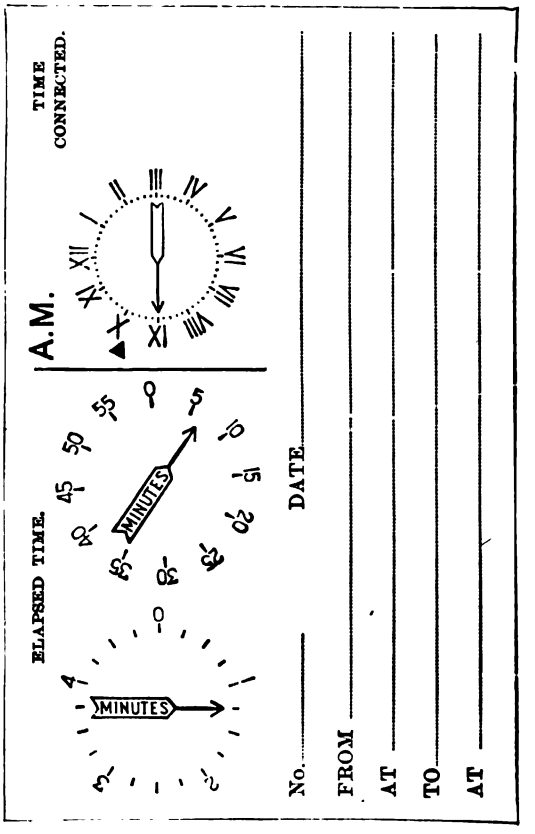


FIG. 9.

of a minute more readily and more accurately than the clock without second hand, though they are liable to the same errors of vision if improperly placed, and do not remove the personal errors. Indeed the use of the second hand adds to the labor of the operator. She is required to read the clock dial with more care and attention at each connection and disconnection, and to write upon the check the seconds shown upon the clock dial as well as the hour and minute.

In an exchange where clocks with second hands were substituted for the plainer variety, it was found impossible for the operators to handle as much business as formerly. They had been managing eight trunk lines each; and in attempting to record on the toll checks the minutes and seconds, they soon fell behind in their records so far and became so hopelessly entangled that the effort had to be abandoned. Subsequently, a different distribution of trunks was made, each operator handling six, and a test of one hundred connections made with the following result, viz.: Eight records showed errors of more than one minute each; nine showed errors between thirty and sixty seconds each; and eighty-three records were within thirty seconds of the time taken by the inspectors with stop watches. When the operators were given five trunks each, the errors shown were as follows, viz.: More than one minute, five connections; from thirty to sixty seconds, eight connections; less than thirty seconds, eighty-seven connections.

When the operator's load was reduced to four trunks each, the result was: Errors of more than one minute each, four; from thirty to sixty seconds, two; within thirty seconds, ninety-four. In each of these three cases, expert operators were employed, and they had full knowledge of the progress of the tests.

The stop watches used were set so as to agree exactly with the clocks, they having been previously regulated so as to run practically in unison. It was believed, therefore, that a comparison of the time recorded upon the checks with that obtained by listening in would show whether the errors were due to reading the clock dial wrong or to lack of supervision. For

Digitized by Google

example, when, upon comparison, it was found that the operator's time for connection and disconnection agreed with the time obtained by listening in as to seconds, but varied as to minutes, the error was thought to be due to incorrect reading of the clock dial. Thus, in the test made on six trunks, of the eight errors exceeding one minute each, five were credited to lack of supervision and three were charged to the account of vision.

3d. Clocks showing figures through openings in the dial have been employed in telephone exchanges for timing messages for the reason that errors due to an oblique view of the dial do not occur, and all operators in the exchange (if it be one of moderate size) may see the time alike at the same moment on the dial of a single clock.

The most practicable form of construction employed in such clocks is that which drives forward in a sudden jump the figures representing the minute at the end of each minute, and the figures representing the hour at the end of each hour. One minute is thus exposed to view continuously until the following minute is completed. See Fig. 3. It will be obvious that fractional parts of a minute cannot be recorded by the use of a clock of this style. Unless, therefore, the operator has her eyes fixed continually upon the clock face, a possible error of fifty-nine seconds may occur in every record. While, therefore, one variety of error has been eliminated by the employment of this style of a clock a new form of error quite as dangerous has been introduced, and the personal equation remains the same.

4th. Time Stamps when employed in telephone exchanges for timing toll messages mark a decided step in advance of the visible clock dial, in that a printed record is made upon the toll check by the stamp without the intervention of pencil or vision. Thus, nominally, errors due to both memory and vision are eliminated. I shall consider what happens in practice.

At the present writing, time stamps available for this purpose (in the market) are of a great variety of construction, ranging in quality from good to indifferent, bad to execrable. All are constructed to print the hour of the day, some shift automatically from a. m. to p. m.; others require these letters to be shifted by the operator when the hours of 12 noon and midnight are passed. Some styles record also the day of the month and year, shifting automatically; others require such mechanism to be set daily.

A common form of construction has the figures of the printing dial arranged in a circle similar to those of a clock dial, but placed in a horizontal plane at the top of the instrument. The pointers which indicate the hours and minute are made to rotate in the centre of the dial, and in order that both pointers and dial may be printed at the same time, their tops or printing surfaces are in the same plane. Since these pointers, obviously, cannot cross each other in their revolutions, as do the hands on the visible dial of a clock, and still remain in the same plane for printing purposes, it is usual to make the hour pointer in the form of a triangle, and it is placed within the circle of figures with its apex pointing outward and adjacent to the figures. The minute pointer is usually made in the form of an arrow; and since it travels faster, making twelve revolutions to one of the hour pointer, it must pass it as many times, and to accomplish this it is placed in the centre of the circle and is made short, that its point may pass the heel of the hour pointer. Thus, in a printed impression made by a time stamp of this type, the point of the minute indicator is a long distance from the divisions or minute marks of the circle, as shown in the diagram. See Fig. 4.

As will appear upon examination of this diagram, it is difficult to determine at a glance which minute mark on the circle is indicated by the pointed, unless one place a straight edge across the centre of dial. An error of one or more minutes might thus be made in reading a record made by this style of time stamp. Moreover, in instruments of this class, the gear wheels which actuate the pointers have considerable play (back lash), and when the printing platen is brought down upon the dial by a blow from the fist or palm of the hand, the pointers are liable to jump forward or backward sufficiently to cause an error in the printed record of from two to three minutes, thus rendering this type of time stamp wholly unfit for accurate records.

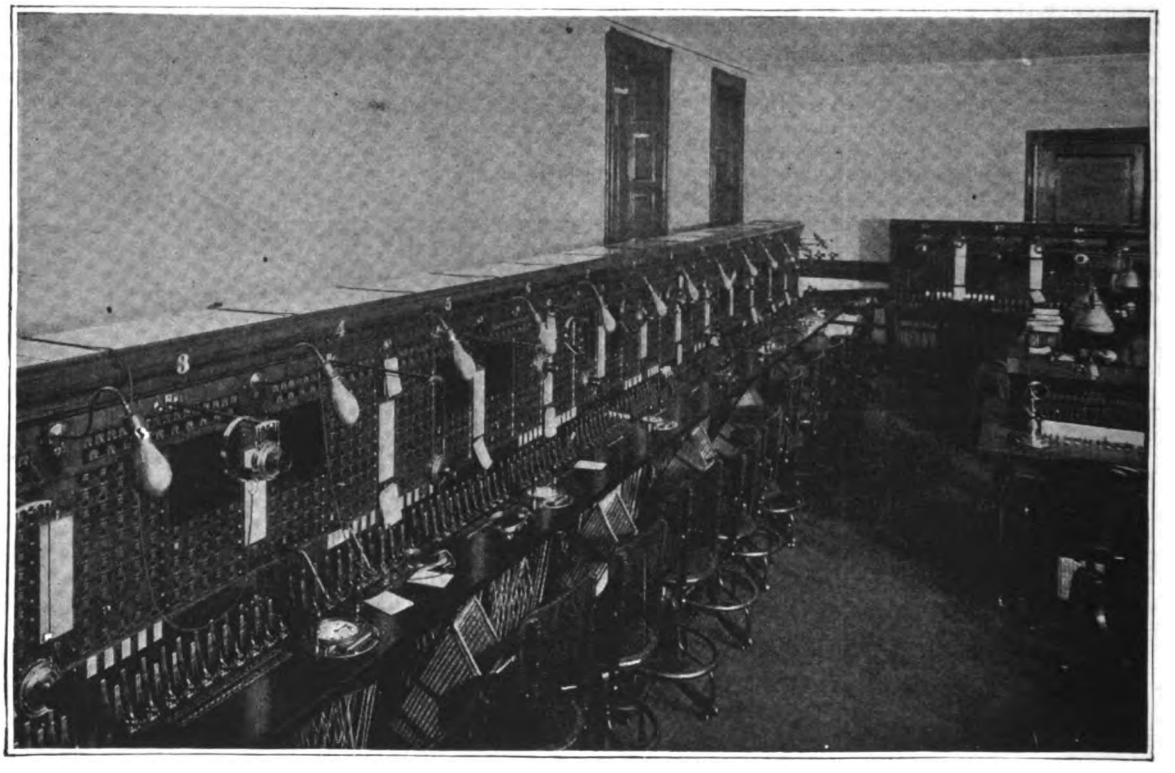


FIG. 13.

For the purpose of eliminating the errors due to the great distance between minute pointer and minute divisions, another form of time stamp is made with a single stationary pointer and two revolving dials, one having figures to represent the hours, the other figures representing minutes, the latter revolving outside and adjacent to the pointer, as indicated in Fig. 5. In this construction, however, the same back-lash occurs between the wheels which actuate the dials and the same errors occur from this cause.

In another type of time stamp, figures to indicate hours and minutes are arranged upon the periphery of wheels, which are placed in a vertical position under the printing platen, those

Digitized by Google

figures only which indicate the time being printed. Other wheels indicating date are often added. A printed impression from this style of construction is shown in Fig. 6. This is the most easily read of any time stamp record, being clear and distinct. The printing wheels in this construction, however, are actuated by a step by step mechanism, the minute wheel jumping forward at the end of each minute. It is, therefore, possible for each record to show an error of fifty-nine seconds, in the same manner as do clocks considered under our third heading, which show figures through a hole in the dial. In timing toll messages with time stamps, it is necessary to make a printed record upon the toll check when the connection is made, and another at the time of disconnection; then either the operator or some other person charged with such duty must subtract the one from the other in order to arrive at the elapsed time, upon which the charge is based. Herein an opportunity is presented for the personal error to enter, and it will appear that the time stamp is not the ideal device for timing toll messages. The available time stamps of the present are all, I believe, with one or two unimportant exceptions, operated by striking a blow of considerable force. Those familiar with the operation of telephone exchanges need not be reminded that the noise and jar consequent upon the pounding of several time stamps on a switchboard would soon become an intolerable nuisance, not to mention the bruising of the operator's hands. The necessity for such pounding in the operation of time stamps is moreover an inherent weakness in all instruments so constructed, directly affecting the time-keeping mechanism, making frequent repairs imperative and shortening the life of the instrument. The several attempts to remedy this defect by separating the timing from the printing mechanism and connecting the two by rods, pneumatic or electrical devices, have been only partially successful.

5th. Stop Watches, when employed in timing toll messages, makes possible great accuracy, as, if the operator has little other work to engage her attention each message may be timed to the second; and, moreover, it is not necessary to subtract the commencing from the finishing time, the elapsed time being indicated by the position of the pointers upon the watch dial at the moment they are stopped, by pressing the button when the conversation is completed. Thus the possibility of errors in subtraction are eliminated and if the visible record of time consumed in the conversation is at once written down upon the toll check before the "push piece" or button of watch is pressed to restore the pointers to the zero mark, errors chargeable to the memory do not enter into the record. In a busy exchange this is not always possible, especially where prompt service is rendered, and the watch is often started off upon the measurement of another message before the elapsed time of the first one is written down. Thus, in practice, the memory of the operator is made a factor even where the message is at first accurately timed.

As but one message can be timed by a stop watch at once, it is obvious that several watches must be used by each operator, at least one for each trunk line, and the watches should be arranged in a rack and numbered to correspond with the trunks, as indicated in Fig. 7. Stop watches suitable for this purpose should be provided with both second and minute pointers, which return to the zero mark on the dial by pressing the button or winding crown. It is not essential that they should also show the time of day. Indeed the additional pointers on the dial necessary for such purpose are likely to be confusing to the operator and afford occasion for an incorrect reading.

Accurate and reliable stop watches may be procured at a cost of from $15.00 to $25.00 each. Many cheaper varieties are in the market, some of them selling as low as $3.50 to $5.00 each, but these are so poorly constructed and so roughly finished as to be wholly unreliable and absolutely worthless for the purpose for which they are designed.

I have never seen stop watches of the better class used in telephone exchanges, probably because of the considerable expense involved in equipping a switchboard with the requisite number, viz.: One watch for each trunk line.

In several exchanges watches of the cheaper varieties were found, but they were reported by the managers as "very unsatisfactory," out of order and in the hands of the repairer a great part of the time," and "a constant source of trouble and annoyance." In other places I learned that stop watches had once been used for timing toll messages, but their use had been discontinued for similar reasons.

6th. The Calculagraph is an instrument which makes a printed record of elapsed time, i. e., it mechanically subtracts the time of connection from the time of disconnection and prints upon the ticket the actual time which elapsed during the interval; the operator being required only to insert a ticket in the slot and pull a lever at the commencement and repeat this operation at the finish. For use in telephone exchanges the calculagraph is so constructed as to make such records of elapsed time in minutes and quarter-minutes. For other purposes it is arranged to record elapsed time in hours and minutes. A still further modification of this instrument multiplies the elapsed time by the rate of charge per minute or hour and records the actual amount charged for the service rendered. Such record may be made in dollars and cents or in the denominations of money employed in the several foreign countries. This latter form of the calculagraph is rarely used in telephone exchanges, though it may be employed where a flat rate prevails.

The elapsed time record made by a calculagraph adapted for telephone service is shown in Fig. 8. The left hand dial shows twenty divisions and five figures, the four spaces between each two adjacent figures indicate quarter-minutes. A movement of the pointer on this dial from one space to the next indicates one-quarter of a minute, and a complete revolution five minutes. The right hand dial is divided into twelve spaces, each space indicating five minutes. The pointer on this dial makes a complete revolution in sixty minutes, and passes from one space to the next during the time of an entire revolution by the left hand pointer. Thus, the even periods of five minutes each are read on the right hand dial, and fractional parts of such periods down to quarter minutes are read on the left hand dial. This arrangement of dials is exactly suited for recording toll messages where the charges are based on periods of five minutes each. A similar arrangement of dials may be employed to suit the practice of basing charges for such service on periods of three minutes each.

When a record of the time of day is required in addition to the elapsed time, the calculagraph is provided with a supplementary dial and pointers which make a record as shown at the extreme right in Fig. 9. The triangular-shaped pointer indicating the hour is made to revolve outside the circle of figures and the minute-pointer in the centre is extended so that its point is adjacent to the minute divisions, thus eliminating the objectionable features of the time stamp dial shown in Fig. 4. The time-of-day dial on the calculagraph is printed by giving a backward movement to one of the levers which operate the elapsed time dials.

The complete calculagraph is also provided with visible dial and hands, and is shown in a portable case in Fig. 10. In this form it may be used on a desk or table.

In Fig. 11 it is shown mounted on a stand or pedestal. In Fig. 12 it is shown in a case adapted to be sunk in switchboard shelf with its top flush. Fig. 13 shows one corner of a telephone exchange with calculagraphs fitted into the switchboards.

It will be apparent that what I have heretofore denominated as the error of vision, conspicuously present in the use of a clock with visible dials and pointers, is absent when the calculagraph is employed to measure toll messages. Errors made in subtracting the time of connection from the time of disconnection are also eliminated, as such calculation is made mechanically by this instrument. Errors of the memory and those due to the practice of estimating the time some minutes after the transaction is closed, need not occur in the use of the calculagraph, as the operator may perform the simple operation of pulling a lever to complete a record while her attention is devoted to the needs of some other patron.

The calculagraph goes two steps farther than the stop watch. First, in that while the latter shows, visible on its dial, the elapsed time, the former prints the elapsed time on a ticket; and, second, while the watch can show but a single record of elapsed time at once, the number of such records which may be made by the calculagraph during a single period is limited only to the number of times it is possible for an operator to insert a ticket and pull the lever. It is, therefore, necessary for each operator to use but a single instrument instead of a separate one for each trunk line. Indeed, in many exchanges, two adjacent operators use the same calculagraph, which is placed in the switchboard between them.

Digitized by Google

The calculagraph is noiseless; its operation being effected by pulling levers and is not accompanied by that pounding, bruising of the hand and jarring of the mechanism mentioned in connection with the time stamps. Its platen is not jammed down by a sudden violent stroke upon the dials, causing them to jump backward and forward; but the dials are moved upward by a steady, even pressure against the printing platen while their rotation continues steadily forward, the back-lash being taken up by a retaining spring, the time-keeping mechanism remaining undisturbed.

Tests were made by listening in in 20 exchanges where the calculagraph was employed, 500 connections being tested in each, making a total of 10,000 messages tested, with results showing an average error of less than four seconds per message.

No figures are available indicating what errors occurred in timing messages in those exchanges before the calculagraph was introduced, nor the amounts added to the revenue of the companies by the elimination of such errors; but the managers freely admit a very decided improvement in the service, with a feeling of assurance that no injustice results to any one. It is not claimed by the manufacturers of the calculagraph that it is entirely automatic. It will not pull its own levers, the tickets must be inserted in the slot and against the guides, and its use will not permit dispensing with the service of operators; but it does unquestionably relieve the operators of considerable mental effort, and the simple mechanical operation of pulling a lever to complete one record may be performed while the operator is engaged in helping out some other patron who has encountered difficulties in the service, and greater efficiency is thereby attained. In several of the larger exchanges where the calculagraph has been introduced for timing toll messages, the services of a clerk formerly employed to calculate the elapsed time upon tickets and check up the work of operators has been dispensed with, and the salaries of such clerks saved to the companies; the records left by the calculagraph upon the tickets being considered more accurate than the clerks could possibly make.

Moreover, the use of the calculagraph has made it possible to discontinue the practice of timing toll messages at both ends of the line; one mechanical record of the time of day and the elapsed time made by the sending operator being considered entirely sufficient for all business purposes.

The former practice of timing at both ends could be justified only on the ground that errors were known to be frequent, and the theory that prevailed was, that "both sending and receiving operators were not likely to make the same error at the same time; therefore, a compromise figure taken from some point between the two records must be approximately correct."

When the receiving operator is relieved entirely of the necessity of making out tickets with names of calling and responding parties, time of connection and disconnection, elapsed time and other data, it will be obvious that her efficiency in the other duties of operating should be enormously increased.

A saving is also effected in the cost of the duplicate tickets and the clerical labor involved in comparing and compiling such tickets.

But the item of greatest value to the company saved in this reform in operating methods, consists in relieving valuable trunk lines of such interruptions to profitable business as occur when sending and receiving operators hold up a line while they discuss the question of the correctness of the records of elapsed time each has made on the previous message, and endeavor to agree upon some satisfactory compromise figure, or try to "force a balance."

During the past two years calculagraphs have been quite generally introduced into the exchanges of licensees of the American Bell Telephone Company where any considerable amount of toll business is handled. They are also to some extent used by large business houses whose transactions over long distance telephone lines are of considerable magnitude, for the purpose of checking up and verifying the items of their bills for telephone toll service.

If any reader of The Electrical Engineer may be charged with the management of a telephone exchange, and has heretofore rested secure in the belief that "any method is good enough," shall be persuaded to investigate what happens in the timing of his toll messages, he may be assured of a surprise in learning what the errors cost his company in revenue, and the writer shall feel that ink and paper have not been wasted.

A Great Advance in Fire Alarm Telegraph Protection.[1]

BY J. W. AYDON,

Supt. Fire Telegraph, Wilmington, Del.

I DESIRE to present to the convention a brief description of the most important and recent advance in methods of fire alarm protection, which will make the outbreak of a fire and the sounding of the alarm through the municipal system practically simultaneous. Nothing further than this preliminary statement is necessary to command the attention of this convention, made up as it is of men whose experience teaches them that the smallest space of time lost between the discovery of a fire and the giving of an alarm may often result in serious loss of life and property and add immensely to the dangers and difficulties which fire departments have to contend with in the performance of their duty.

I refer particularly to a combination with the well-known auxiliary fire alarm system of a so-called "Multiphase" cable, which combination makes the auxiliary system automatic as well as manual.

The auxiliary system proper was an immense step forward in this vital matter of minimizing the time between the discovery of a fire and the giving of an alarm, and its record throughout the country for the past six years has been a most excellent one. During this time it has been in quite extensive use in many of the large cities of the United States, and in those places has been a considerable factor in reducing the fire losses, and has been a material aid to the fire departments.

In the city of Wilmington it has rendered exceptional service to property holders and to the department, and has been the means of preventing several serious fires by enabling the fire department to reach the scene of the fire some minutes sooner than would have been the case otherwise.

The auxiliary system, in effect, brought the nearest public fire alarm box into the interiors of buildings, and placed it at any desired number of points, by providing a series of small auxiliary boxes, from any one of which the street box could be instantly operated by the pulling down of a lever contained in each auxiliary box. But the system, being purely manual, was not effective when the protected premises were vacant; and it was to cover this point that the method of rendering the auxiliary system automatic, as well as manual, was perfected.

The great value of an automatic connection with municipal fire departments has been long recognized, and for many years received the hearty co-operation and encouragement of insurance underwriters and fire department officials; and under the fostering influence of these interests it has rendered, and is rendering, most valuable service.

The growth of the automatic system, however, has necessarily been confined to the larger cities, for the reason that it is necessary to maintain the system in connection with its own central office, through which alarms of fire have to be transmitted to the fire department. The expense of wiring and the cost of maintaining a central office equipment is so great that the business cannot be made a commercial success, except in large cities where the volume of business is considerable.

For smaller cities, where the amount of property to be protected is not so large, but relatively equally valuable, the automatic system is not available; but the record of this system covering a period of many years has exclusively proven that a reliable automatic system, available wherever there is a fire department, would be of vast importance.

The successful operation of an automatic system in smaller places is now for the first time in the history of fire telegraphy possible. It has never been a matter of electrical or mechanical difficulty to connect ordinary thermostats into an auxiliary system so that an excess of heat would automatically operate the street box, but the danger of unnecessary alarms has prohibited this.

The recent invention of the "Multiphase" cable, referred to above, has been adapted for use in connection with the auxiliary system, so that it becomes automatic, as well as manual, without the sacrifice of any of the peculiar features of safety from false alarms, which is the foundation of the willingness of fire departments to allow its use in connection with street boxes.

This "Multiphase" cable is of peculiar construction, as will be

[1]Paper read at Municipal Electricians' Convention, Elmira, N. Y.

Digitized by Google

noted from the drawings which I have for your examination. Briefly, it consists of a copper conductor having a fusible metal covering, with insulated material over it, around which is wound a series of small copper wires, the whole being again protected by a slow-burning insulation. This cable is wired into the auxiliary system in the place of the ordinary wire heretofore used, and in connection therewith is run a single wire composed of fusible wire only, and protected with a free-burning insulation.

An automatic-auxiliary equipment would, therefore, consist of the desired number of auxiliary boxes, distributed throughout a building at convenient locations, connected through the usual testing apparatus, with the nearest street fire alarm box. The interior wiring of the equipment would be of this "Multiphase" cable described, and the single fusible wire mentioned, the cable wire being run parallel to each other.

As fires do not start upon the ceilings of rooms (where the ordinary thermostats are placed), the automatic wires referred to would be run around base-boards, back of benches, through closets, under staircases, etc.—in fact, so as to cover every danger point where a fire would be likely to start. These danger points can be scientifically located for each class of risk, by a reference to insurance tables giving the accumulated experience of all the insurance companies for a period of years, as well as by individual judgment in each case.

It will therefore be seen that such an equipment would provide a number of auxiliary stations, which, when manually operated, would instantly get the street box in motion, thereby giving the alarm to the fire department; and would also provide for the covering of all danger points in the building by the automatic cable as indicated.

There is no necessity of describing the operation of the auxiliary system proper—i. e., when operated manually; so we will pass to the working of the "Multiphase" cable when it comes in contact with actual flame.

First, however, let me call the attention of the convention to the fact that it takes actual flame, or a temperature of 360 degrees without flame, to cause this wire to send in an alarm, and this, therefore, prevents false alarms from an overheating of a building, which might not necessarily be dangerous.

This failure to act until the flame comes in contact with the wire or until a temperature of 360 degrees is reached, does not imply that the wire will not give the alarm for an actual fire as quickly as a thermostatic equipment would do; on the contrary, it would doubtless, in most instances, give it quicker, for the reason that every fraction of an inch of the wiring of an auxiliary system would be an alarm-giving point, located where the fire would probably start, instead of being away up on the ceiling, perhaps many feet away from the fire.

The fact that this cable required flame, or a temperature of 360 degrees to operate it, insures it against any liability to false alarms, for conditions producing a temperature at which thermostats act unnecessarily, produce no effect upon it.

Returning now to the operation of the wiring of an auxiliary system equipped with the "Multiphase" cable, under the influence of flame, or 360 degrees of heat; the single fusible wire melts open, and the fusible metal covering of the inner wire in the cable, melts, and forcing its way through the insulation, makes a solid soldered connection with the series of copper wires described.

This action of the wire produces a condition in the auxiliary system, exactly the same as that brought about by the manual pulling of one of the auxiliary boxes, and the alarm through the street box is the immediate result.

This combined system, like the auxiliary system proper, is at all times under automatic test, so that any line or battery disarrangement will be instantly made known. This system combines all of the advantages of an automatic system with all those of the auxiliary system, without any of the disadvantages of the former. It is available wherever there is a street box, in a large city, or small town.

To sum up briefly, the automatic-auxiliary system enables the instant and manual sending of an alarm of fire, and also provides that every fractional part of an inch of its wiring shall be an untiring watchman ready at all times to instantly give the alarm when dread fire makes its appearance.

I think the convention will agree with me that making the fire send in its own alarm is a notable advance in the business to which we are devoting our lives.

Congress Fixes Washington Telephone Rates.

At Washington, on August 4, Judge Hagner, in the District of Columbia Supreme Court, rendered a decision against the Chesapeake and Potomac Telephone Co., and granted an order restraining them from removing instruments from subscribers who refuse to pay more than $50 per year rental. Congress enacted a law limiting the charges to $50 per year for each instrument in the District of Columbia. Several subscribers in Washington refused to pay more, and the telephone company attempted to remove the instruments. James F. Manning & Co. commenced legal proceedings to restrain the telephone company from such action. The latter alleged that the act referred only to Government service, and that as otherwise applied it was unconstitutional. Judge Hagner overruled all of the company's objections and granted a temporary restraining order. The telephone company has appealed.

Telephones in Cape Colony.

Consul General Stowe writes from Cape Town, April 25, 1898: The telephone service of Cape Colony is under the control of the colonial government. On the 9th of April, 1898, there were 1,535 instruments in use, and the revenue for 1897 amounted to $66,137.22. There are 869 miles of wire and 780 subscribers. Seven exchanges in the colony work on the single-wire system, but arrangements are now being made to have all lines duplicated, and in future no exchange will be established except on the metallic-circuit system.

In the course of the next few months the underground cable system in Cape Town will be completed and exchanges established in the suburbs.

Independent Telephony in Michigan.

A special dispatch of August 4 from Grand Rapids, Mich., says: At the annual meeting of the Independent Telephone Association of Michigan, held in this city, J. B. Ware, Grand Rapids, was elected president; Alex. McLeod, Detroit, secretary, and W. H. Tilden, St. John's, treasurer. About 500 Michigan towns now have independent telephone exchanges or connections, and they are divided into three groups. This city is the centre of the largest group, with 300 towns reached. Detroit has about 150, and Saginaw 50. The Detroit and Grand Rapids systems have just been connected by way of Lansing, and the Saginaw system will connect with the other two before the close of the season. It is estimated about 16,000 instruments are in use in the State and this number is rapidly increasing.

Independent Toll Line Telephony in Iowa.

At the meeting of the Iowa Association of Independent Toll Line Telephone Companies on August 11, at Des Moines, the following schedule of toll rates was adopted for a single message:

	Cents.
20 miles or under	.20
20 to 30 miles	.25
30 to 40 miles	.30
40 to 45 miles	.35
45 to 50 miles	.40
50 to 60 miles	.45
60 to 75 miles	.50

Above 75 miles, five-eighths of 1 cent per mile.

This schedule takes the place of the schedule of rates according to counties through which messages passed. The old percentage of division of receipts was retained. It provides that where a message goes over two lines the originating line gets 60 per cent. of the receipts and the other company 40; in case of three companies, the originating line gets 50 per cent. and the other two 25 each, and in case of four companies, the originating company gets 40 per cent. and the other three 30 each.

WESTERN TELEPHONE CONSTRUCTION CO. has issued a huge colored broadsheet full of very useful and interesting information in regard to features of exchange and toll line equipment. It is well illustrated by cuts of apparatus and diagrams, and is well worth study.

THE FRENCH CABLE CO. has been celebrating the opening of its new cable by messages of kindliness between Presidents McKinley and Faure.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1888.]

Vol. XXVI. NEW YORK, AUGUST 25, 1898. No. 538.

Moribund Manhattan.

AT a time when nearly every railroad property in the country is either increasing its dividend rate or its surplus, or is getting upon a dividend basis, the Manhattan Elevated of New York distinguishes itself by losing traffic steadily in the biggest city in the Union and in a centre where travel is growing at a tremendous pace. It now has piled up a floating debt of over $1,000,000, it is not earning its 4 per cent. dividend, and each report of traffic goes from bad to worse. The last quarterly report showed a deficit of $16,000 as compared with a surplus of $89,000 for the corresponding period of 1897. We hesitate to use the word "moribund," in regard to the splendid Manhattan property, but it is difficult to find one that is more appropriate for such a state of affairs.

The great question is: Can the Manhattan Railroad be revivified? We believe it can be and that electricity will do it. Such an opinion might naturally be expected from an electrical journal, but as we recommended the change, by way of a precautionary measure, before its fortunes went to the bad, we feel no hesitancy in urging it strongly again, especially as those in authority hesitate so long about this vital matter. It might be said that, electricity or not, the competition of the Metropolitan Traction surface cars is responsible for the whole trouble and that their advantages cannot be offset, especially as the system is still extending and is sapping the patronage of the Manhattan at a growing number of points. In other words, it is claimed that the elevated roads have lost their short distance travel and cannot regain it.

This is a view of the situation we do not take; and as the Metropolitan is emphatically an electrical system and has achieved its notable success by becoming so, we might urge the argument that conditions would be equalized by the Manhattan following suit. The Elevated had once to compete with the horse cars and cable cars, and held its own against them, even on the short travel, but now that the surface cars have dispensed with horses and have adopted mechanical traction, becoming cleaner, neater and more brilliant, they have jumped into great popularity. Yet even for short distances they do not strike us as always surpassing the elevated cars in speed between many given points. We have tried it repeatedly, but have gone back to the Elevated if in a hurry. Otherwise, the surface cars get our preference; and, besides, there are no stairs to climb and there are no long waits.

Now let us see what the Elevated could do. First of all, it could adopt electricity. In fact, it must do so, or die, i. e., become bankrupt, living then only on through travel, limited chiefly to expresses. In making this change to electricity the Elevated will get rid of its villainous coal dust and other incidental annoyances. You can rarely go up and down town by the road without getting its dust in your eyes or over your clothes, and if you walk underneath it, you have to dodge cinders and oil and drippings and dust all the time. It is distinctly barbaric and antiquated. Then, in changing to electricity, the cars can be better lighted and better heated, while in summer open cars could be run, on regular schedule, something that is now impossible with steam for locomotion. Last of all, elevators could be put in at all the stations with long flights of stairs; and there are few without such flights, turning away many delicate passengers daily, because of the exertion they necessitate.

There are some apologists for the Manhattan Company in its long delay, and among them high authorities. For example, Col. H. G. Prout, editor of the "Railroad Gazette," in a recent able and thoughtful article said:

"Whether or not electricity would save anything in cost of operation in this special case is a matter of debate among experts. The steam locomotives now used on the Manhattan Elevated are efficient machines, and, taken all in all, the elevated railroads of New York give the people a service which, in the combination of the magnitude of the traffic, the safety with which it is carried, the speed, the regularity, the comfort and the economy, is unparalleled in the history of transportation; it is probable no other instance can be found in which these elements are combined on such a scale. But, further, the service is possibly the most intense in the world, and an interruption causes inconvenience to thousands of people. But with the steam locomotive each train is a self-contained unit, and an accident to that train does not necessarily interrupt the traffic over the whole line or interrupt it for a considerable time, but with electric working the whole system is on one string. A failure in the power house or in the conductors stops everything. In practice this difficulty is not as serious as it is in theory, but the danger is present, and the prudent engineer is bound to think of it when he decides between steam and electricity."

This seems to us praise too warm for a service that in reality is dying of dry rot. Conceding all that is put forward to be true, there is left the great fact that people have found and go on finding something better in the Metropolitan Traction service. Besides, there is implied a condemnation of every modern trolley or cable system, for they all depend on power houses instead of individual self-contained motors. We have yet to gather from our prolonged observation that they are more liable to delay, stoppage and breakdown than the Elevated has been; although they do not enjoy the long sidings, switches and turnouts which enable the Elevated, unhampered by street travel, to lift a blockade, as it has often to do. Without its "third track" the Elevated would, we fear, from what we see, be "tied up" every day of the week, in spite of its self-contained motors; whereas it is likely that if one power house were shut down for any cause, the Metropolitan Traction Company could throw current in from others, over alternative conductors, at the desired points. Why it should be supposed that the Manhattan Elevated must depend on one, or even on two, power plants we do not exactly understand. To say the least, that is not the existing practice on electric surface roads of any magnitude.

If we figure it aright, the Manhattan system has to pay fixed charges on about $40,000,000 and has $30,000,000 of stock. Its rate of dividend was reduced in April, 1897, to 4 per cent., but now it is not earning that; and soon it may not be able to meet its fixed obligations. It is no wonder that the stock has fallen below par, even in these days of widening prosperity, in an expanding city, when the Metropolitan Traction cannot get cars enough for its passengers. The cost of introducing electricity is put at about $8,000,000. Let us call it $10,000,000. Four per cent. on that is $400,000, which means 8,000,000 fares a year, or about 22,000 a day. It does not seem to require much boldness on our part to predict that with an electrical equipment permitting it to run trains under greater acceleration and shorter headway, and yet in units from one car up, the road would at once carry not merely 22,000 people more every day but 100,000.

The Manhattan road has been an inestimable boon to the citizens of New York. It still remains so, but its usefulness is lessening as the city and municipal needs grow, and a change must come. That change may perhaps be found in absorption by the Metropolitan, whose vigor, alertness and progressiveness have been in curious antithesis to the sad, Spanish apathy and indifference of the Manhattan management. We do not wish to condemn unfairly, but the Manhattan figures are stronger than anything its critics may indite.

Digitized by Google

When Jackie Comes Sailing Home.

IT was indeed a glorious week, the one just passed, one of the proudest episodes in American history. It was a week of welcome, days of thrilling excitement and paying of homage to those who on land and sea alike have won glorious and decisive victories. Our soldiers, brave and true, have returned to their native land, and, worn out by weeks of privation, exposure to the elements and an unfavorable climate, have been sent to healthful camping grounds for recuperation and treatment. Our naval heroes and our "Jackies" who in so short a space of time gave to Spain the largest submarine navy in the world, have again touched our shores amid a royal, American welcome. We have learned to love those brave and fearless boys and are proud of their triumphs and victories.

But apart from the pride which these events have naturally awakened, the war just closed has taught us more serious lessons, namely, those relating to the science of war, such as the armament of troops and vessels and the handling of machinery on board a man-of-war. It is true that the entire scheme and system of our electrical installations on shipboard has been, from the nature of the case, progressive, but we may confidently say, they have shown a steady improvement in details and efficiency. Electricity is being used for every conceivable purpose, so as to minimize as much as possible the present objectionable heat of long lines of steam piping, the annoying leaks of hydraulic apparatus and the excessive weight of pneumatic appliances. To this may be added the fact that a break in a steam or hydraulic pipe could easily drive every one from the compartment. Perhaps the greatest argument, however, in favor of electricity is the ready change from electrical to hand control in emergency, and the facility of maintaining and repairing the leads. As a proof of the perfect control of electrical power as applied to turrets, we may mention the instance at a trial on the Brooklyn at Cramp's shipyard, when the turret was successfully started and stopped thirty-seven times in a peripheral distance of one inch in the same direction, a result which challenges competition.

These and other, now apparently indispensable apparatus, and the generating plants, have been brought to a high state of efficiency through the research and patient insistence of those who worked out its early details. What we need most now is care and skill in manipulation. Lieutenant B. T. Walling, U. S. N., in a lecture delivered before the U. S. Naval War College, tells us that "continuity of service and endurance of our plants is now suffering from lack of interest and apathy on the part of officers." This criticism, made before the war, has by no means been borne out by the successful maneuvering of our ships and guns during the critical moments of warfare and in the midst of battles and bombardments. But be this as it may, the apparatus on board our men-of-war must certainly have suffered from the severe duties to which it has recently been subjected and, like our wounded heroes, it needs care and treatment. Machines, like the sailors, are only serviceable when in sound condition, and are liable to get ill and unfit for duty for lack of attention of from overexertion. Now is the time to administer the medicine and correct faults of early work which must have been brought to light by the exacting requirements of actual service. Many of our ships still have antiquated and inefficient generating sets on board which should be substituted at once by the most modern and improved types. More perhaps than in any other portion of the ship, cleanliness should be insisted upon in the engine and dynamo rooms, and all leaks into them be carefully sealed, as lack of cleanliness and presence of salt water are the inveterate enemies of electricity on board ship. Lieutenant Walling points this out as one of the many diseases of electrical installations in the navy, of which he appears to have made a careful study. He tells us of the practice of putting paint on the end conductors of armatures for appearance sake, a material more baneful to armature coils than oil and dirt, not only on account of the deteriorating effect of its oil on rubber, but through the non-conducting layer established. Once applied it cannot be removed, and when dirty it is cleaned by another coat of paint, producing more resistance to radiation. Usually the armature burns, he says, occur at these very end conductors.

He also points to the unnecessary vibration and noise due to the running machinery, all of which can be easily abolished by proper support and location and the adjustment and smooth running of all parts and fittings. Many of our switchboards, says Lieutenant Walling, have been insufficiently supported, thereby bringing a stress upon and loosening the circuit connections of the panels. He further points out the inadvisability of using marble for switchboards and porcelain for insulating knobs and other purposes on account of their liability to break, and suggests the use of micanite, properly framed by an insulating material such as a vulcanized rubber composition. He decries the value of lead covered wire, on account of the difficulty of its repair, the manipulation consequent upon its weight and the almost certain breakage at bends and angles. It has fallen short of the anticipated advantages claimed for its use in heated locations and is peculiarly susceptible to electrolytic action.

It appears that now, when most of our ships will be put in dry dock, is the time to remedy these and other shortcomings which are said to exist in our naval electrical installations, and make such changes as have suggested themselves during the recent engagements. It is but another instance of preparing for war in time of peace.

Scaling Down and Scaling Up.

ONE of the most interesting passages in Reid's history of the telegraph in America is that in which is described the doubling up of the capital of the Western Union Telegraph Co. from $11,000,000 to $22,000,000 in the flush times of the Civil War period. The stock was being quoted at 225, and so the change was felt justifiable. "It seemed a splendid achievement thus, by a breath, to create $11,000,000" by means of a stock dividend of 100 per cent. This increase was followed by others, due to consolidations, and $25,000,000 soon became $41,000,000. But the rub came when dividends had to be paid on this capitalization, and then the burden was felt in its true weight.

To-day the Western Union earns and pays its dividends on $100,000,000, a capitalization which seems but fairly to represent the intrinsic worth of the property. We venture therefore to hope that in due time the General Electric Co. may find its history, which has been parallel in many respects though not in all, following the same upward curve. Last week the General Electric Co., instead of scaling up, followed the reverse and less pleasant practice of scaling down, and "at a breath" reduced its capital to $20,827,000, wiping out about $20,000,000. It is but a few years ago that upon the union of the Edison and Thomson-Houston companies all this water was injected into the corporation that has now been squeezed out. At that time in spite of the general enthusiasm, some shrewd observers doubted the company's ability to earn dividends, but things looked rosy until the panic of 1893 came, and with it the smash. Stock then selling at about 115 has since sold at 30. Such a drop was inevitable, for in July the company owed $1,488,000 accumulated dividends on its preferred stock, and had paid nothing on its common stock since August, 1893.

The present scaling down includes $4,000,000 knocked off the patent account, a reduction which can only be commended and which, as we have often urged, ought to have been made long ago. As to the general reduction, it looks like serious injustice to the preferred stockholders; but all depends on the point of view. When a ship is badly swamped, anything goes overboard that will lighten her. The main thing is to get her righted and keep her buoyant. This we take to be the aim of the directors of the company, many of them men of highest standing and reputation. There may have been gambling in the common stock, which apparently benefits at the expense of the preferred, but the dealings in the stock for months past give little sign of it. If there has been a "play" of that kind, its evidences are to be looked for rather in the future.

Now that the water has been squeezed out of this great property, we trust it will be able to earn and pay steady dividends. That will be one of the best things that could happen to the growing industry of electric light and power. For the General Electric Co. to sink out of existence with all that it represents of genius, effort, invention, investment and opportunity, would be one of the worst disasters to the general electrical industry we can imagine. If any word of ours counts with the management, we would again recommend a conciliatory policy, for whatever present patents may be worth, they will always undergo diminution as the art advances and widens, and no art amplifies more quickly than the electric. If the General Electric is to prosper, and we heartily trust it may, it will do so by making friends, not enemies. Of the latter it has enough already, and they are not enemies by their own choice.

Digitized by Google

MISCELLANEOUS

Tesla Circuit Controllers for Obtaining Oscillatory Currents of High Frequency.

ON August 16 a very ingenious and apparently significant group of patents was issued to Mr. Nikola Tesla, comprising several types of current-interrupting devices for obtaining oscillatory currents of very high frequency. Mr. Tesla has called them "electrical circuit controllers" and their use and construction may be understood by the following introductory remarks, taken from the patent specification referring to the class of circuits for which they were designed. We present also several illustrations showing the latest forms developed by Mr. Tesla, whose persistent investigations along the high frequency line entitle him to much praise and credit.

In every form of electrical apparatus involving a means for making and breaking more or less abruptly, a circuit, a waste of energy occurs during the periods of make or break, or both, due to the passage of the current through an arc formed between the receding or approaching terminals or contacts, or, more generally, through a path of high resistance. The tendency of the current to persist after the actual disjunction or to precede the conjunction of the terminals exists in varying degrees in different forms of apparatus, according to the special conditions

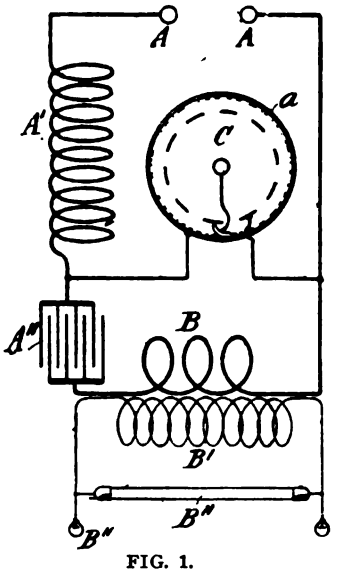


FIG. 1.

present. For example, in the case of an ordinary induction coil the tendency to the formation of an arc at the break is, as a rule, the greater, while in certain forms of apparatus in which the discharge of a condenser is utilized this tendency is greatest at the instant immediately preceding the conjunction of the contacts of the circuit-controller which effects the discharge of the condenser.

The loss of energy occasioned by the causes mentioned may be very considerable and is generally such as to greatly restrict the use of the circuit-controller and render impossible a practical and economical conversion of considerable amounts of electrical energy by its means, particularly in cases in which a high frequency of the makes and breaks is required.

Extended experiments and investigation conducted with the aim of discovering a means for avoiding the loss incident to the use of ordinary forms of circuit-controllers have led Mr. Tesla to recognize certain laws governing the waste of energy and making it dependent chiefly on the velocity with which the terminals approach and recede from one another and also more or less on the form of the current-wave. Briefly stated, from both theoretical considerations and practical experiment, it appears that the loss of energy in any device for making and breaking a circuit, other conditions being the same, is inversely proportional rather to the square than to the first power of the speed or relative velocity of the terminals in approaching and receding from one another in an instance in which the current-curve is not so steep as to materially depart from one which may be represented by a sine function of the time; but such a

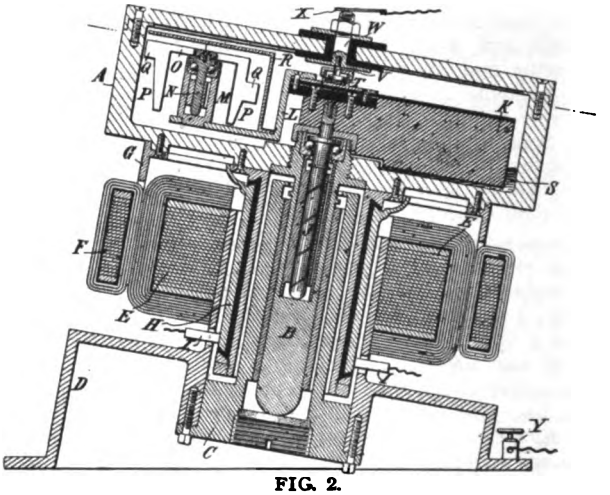


FIG. 2.

case seldom obtains in practice. On the contrary, the current-curve resulting from a make and break is generally very steep, and particularly so when, as in Mr. Tesla's system, the circuit-controller effects the charging and discharging of a condenser, and consequently the loss of energy is still more rapidly reduced by increased velocity of approach and separation. The demonstration of these facts and the recognition of the impossibility of attaining the desired results by using ordinary forms of circuit-controllers led Mr. Tesla to invent other means for making and breaking a circuit in which he has utilized a conducting fluid, such as mercury, as the material for one or both of the terminals and devised novel means for effecting a rapidly-intermittent contact between the fluid and a conductor or series of conductors forming the other terminal.

In this apparatus one of the members or terminals is a conducting fluid which is caused to issue from an orifice against a series of spaced conductors in rapid succession. For this purpose the series of conductors, or it may be a single conductor, is moved transversely through the stream or jet of fluid, or the jet is moved so as to impinge upon the conductors, or both jet and conductors are moved. This is preferably accomplished

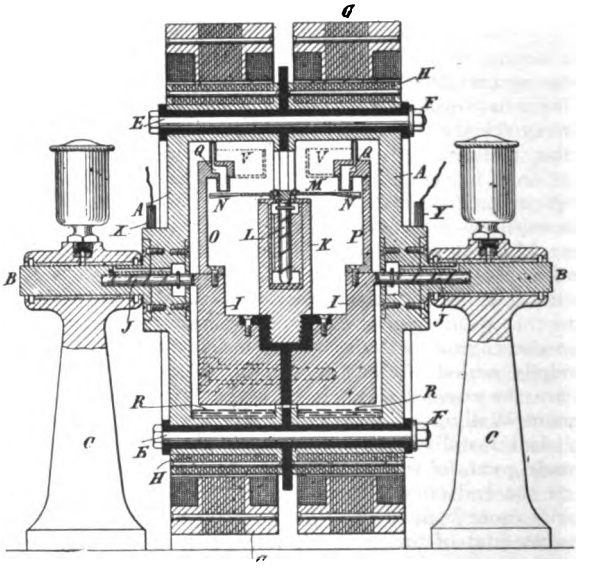


FIG. 3.

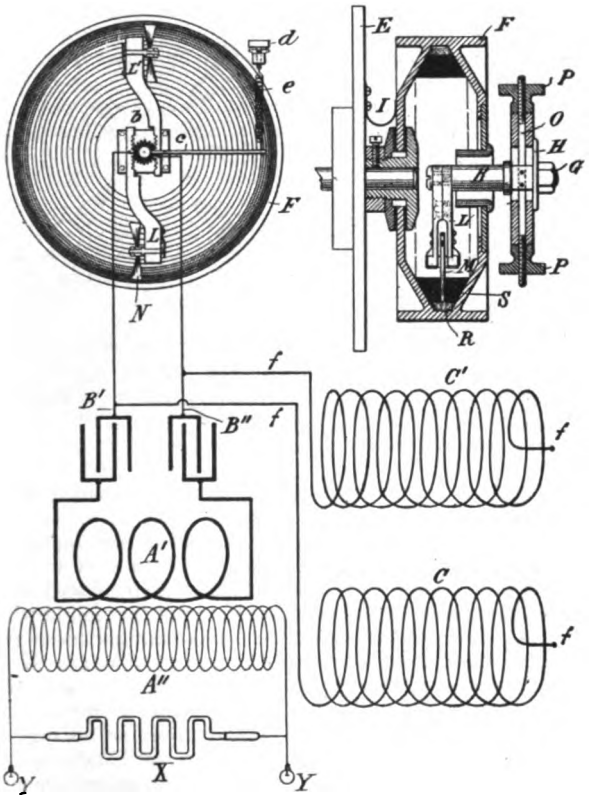
by mounting the conductors and the tube or duct from which the fluid issues concentrically and revolving one or both.

The plan adopted for maintaining the stream or jet of conducting fluid consists in utilizing the same power that actuates or drives the circuit-controller in effecting the necessary rela-

Digitized by Google

tive movement of its terminals to maintain the proper circulation of the conducting fluid by combining the two mechanisms (the controller and the means for maintaining a circulation of the conducting fluid) in one. This feature is of great practical advantage and may be effected in many ways. A typical arrangement for this purpose is to provide a tube or duct having an orifice at the end directed toward the spaced conductors and its other end in a position to take up a portion of the rapidly-rotating body of conducting fluid, divert it through the duct, and discharge it against the conductors. With this object when a closed receptacle is used a holder for the tube is employed, mounted within the receptacle and concentrically therewith, and this holder, when the receptacle is revolved, is held or influenced by any suitable means, as by magnetic attraction exerted from the outside or otherwise, in such manner as to keep it either in a fixed position or impress upon it a velocity different from that of the rotated fluid.

The general scheme of the system for use with which the circuit-controllers are more especially designed will be understood by referring to Fig. 1. In this figure A A represent the terminals of a source of current. A′ is a self-induction or choking coil included in one branch of the circuit and permanently connected to one side of a condenser A″. The opposite terminal of this condenser is connected to the other terminal of the source through the primary B of a transformer, the secondary B′ of which supplies the working circuit containing any suitable translating devices, as B″.



FIGS. 4 AND 5.

The circuit-controller C, which is represented conventionally, operates to make and break a bridge from one terminal of the source to a point between the choking-coil A′ and the condenser A″, from which it will result that when the circuit is completed through the controller the choking-coil A′ is short-circuited and stores energy which is discharged into the condenser when the controller-circuit is broken, to be in turn discharged from the condenser through the primary B when these two are short-circuited by the subsequent completion of the controller-circuit.

Six different constructions of circuit controllers have been patented by Mr. Tesla in this group referred to in the beginning of this article, but we have selected three of them which illustrate fairly well the various types for which patents were granted.

Referring to Fig. 2, the operative portions of the circuit-controlling mechanism are contained in a closed cylindrical receptacle A, of iron or steel, mounted on a spindle B in a suitable socket or support C to permit it to be freely and rapidly rotated. The socket C is secured to or forms a part of a base or stand D.

As a means of producing the proper rotation of the receptacle A, a field-magnet E is shown, mounted on or secured to the base D, and an armature F, supported by a bracket G from the under side of the receptacle A. The same bracket also carries a series of commutator-segments H, upon which bear brushes I, these parts being arranged to constitute an electromagnetic motor with stationary field and rotating armature. Any other suitable means, however, may be employed to rotate the receptacle and the fluid.

In the spindle B and concentric with its axis is a spindle J in bearings specially constructed to reduce friction in order that the spindle J may be as little as possible influenced by the rotation of the main spindle and receptacle which it carries. A suitable provision is made to oppose or prevent the rotation of the spindle J during the rotation of the receptacle. For this purpose the following has been devised.

The spindle B is held by its bearings at an angle to the vertical, and a weight K is secured eccentrically to the spindle J and tends to hold the spindle always in one position. The inclination of the axes of rotation necessary for this result may be as shown, and should not be greater, for the reason that it is especially advantageous to preserve the spindles and bearings as nearly as practicable vertical on account of lesser friction and easier lubrication.

Attached to the spindle J or weight K is an insulated bracket L, carrying a standard or socket M, in which is mounted on antifriction-bearings a spindle N. Secured to this latter is a plate with radial arms O, from which depend vanes or blades P, with projections Q extending radially from it. A shield or screen R incloses the vanes, except on the side adjacent to the inner periphery of the receptacle A.

A small quantity of a conducting fluid S is placed in the receptacle, and in order to secure a good electrical connection between the vanes P and a terminal on the outside of the receptacle a small mercury-cup T, in metallic contact with the vanes through the bracket L and socket M, is secured to the weight K. A metal stud V, set in an insulated bolt W, projects into the cup T through a packed opening in its cover. One terminal of the circuit-controlling mechanism will thus be any part of the metal receptacle and the other the insulated bolt W. The apparatus may be connected up in circuit by connecting the wires of the circuit to a brush X, bearing on the bolt W, and to a binding-post Y in contact with the base D.

To operate the apparatus, the receptacle is set in rotation, and as its speed increases the mercury or other conducting fluid which it contains is carried by centrifugal force up the sides of the inner wall, over which it spreads in a layer. When this layer rises sufficiently to encounter the projections Q on the blades or vanes P, the latter are set in rapid rotation, and the electrical connection between the terminal of the apparatus is thereby made and broken, it may be, with very great rapidity.

The projections Q are preferably placed at different heights on the vanes P, so as to secure greater certainty of good contact with the mercury film when in rapid rotation.

Fig. 3 is a central vertical cross-section of another type, which involves two salient features of novelty, one that it provides for maintaining in a rotating receptacle a stationary jet or jets which by impinging on a rigid conductor maintain the latter in rotation, thereby securing the requisite rapidly-intermittent contact between the two, and the other that it utilizes the rotation of such rigid conductor as a means for opposing or preventing the movement of its own supports in the direction of rotation of the receptacle, thereby securing, among other things, an approximately constant relative movement between the parts, a feature which in devices of this kind is often very desirable.

Referring to the figure, A designates a receptacle, usually of iron or steel and mounted in any suitable manner, as by trunnions B B, having bearings in standards C C, so as to be capable of rapid rotation about a horizontal axis.

The receptacle is divided into two parts insulated by a washer D and held together by insulated bolts E with nuts F. These two parts are electrically connected, respectively with the two terminals of the apparatus, and by means of brushes X Y, bearing at any suitable points on the two parts of the receptacle, the circuit-controller is connected with the wires of a circuit.

Digitized by Google

Any convenient means may be employed to rotate the receptacle; but a simple way to effect this is to surround the same with a field-magnet G and to make the receptacle itself the armature of an electric motor or else to secure to it armature-cores, as H.

A body I is supported by trunnions J, having bearings in the ends of the receptacle and concentric with the axis of rotation of the same. The weight of the body I being eccentric to this axis tends to oppose its turning about the axis when the receptacle is rotated.

Upon the body or support I, but insulated therefrom, is secured a vertical standard K, in which there is a freely-rotatable spindle L, carrying a disc M, with radial arms inclined to the plane of the disc, so as to form vanes N. Arms O P are also secured to the body I and are formed with or carry at their ends ducts or tubes Q, with one end directed toward and opening upon the vanes N, and the other end close to the inner wall of the receptacle and opening in the direction opposite to that of the rotation of the receptacle.

A suitable quantity of mercury R is placed in the receptacle before the latter is sealed or closed.

The operation of the device is as follows: The receptacle is started in rotation, and as it acquires a high velocity the mercury or other conducting fluid R is caused by centrifugal action to distribute itself in a layer over the inner peripheral surface of the receptacle. As the tubes or ducts Q do not take part in the rotation of the fluid, being held at the start by the weighted body I, they take up the mercury as soon as it is carried to the points where the ducts open and discharge it upon the vanes of the disc M. By this means the disc is set in rapid rotation, establishing the contact between the two sides of the receptacle which constitute the two terminals of the circuit-controller whenever the two streams or jets of fluid are simultaneously in contact with the vanes, but breaking the contact whenever the jets discharge through the spaces between the vanes. The chief object of employing more than one insulated jet is to secure a higher velocity of approach and separation. The disc M, having acquired a very rapid rotation, operates to prevent by gyrostatic action any tendency of the body I to rotate or oscillate, as such movement would change the plane of rotation of the disc. The movement of the parts, therefore, and the operation of the device as a whole are very steady and uniform, and a material practical advantage is thereby secured. The speed of the disc will be chiefly dependent on the velocity of the streams and pitch of the blades, and it is of course necessary in order to produce a constant speed of rotation of the disc that the velocity of the streams be constant. This is accomplished by rotating the receptacle with a constant speed; but when this is impracticable and the uniformity of motion of the disk very desirable special means are resorted to to secure this result, as by providing overflowing-reservoirs V V, as indicated by dotted lines, from which the fluid issues upon the vanes with constant velocity, though the speed of the receptacle may vary between wide limits.

In Fig. 4 is shown a central vertical section of an improved circuit controller and Fig. 5 represents the latest and most preferred form, showing it in connection with the remaining parts of the apparatus illustrated diagrammatically. In these forms the receptacle contains both a conducting and a non-conducting fluid, the former being the heavier, and the terminals are maintained in such relations that the electrical connection between them is made and broken by the successive immersion of the contact-points into and their withdrawal from the conducting through the non-conducting fluid. These relations are best maintained by such construction of the receptacle that the distribution of the two fluids necessary for the proper operation of the device may be preserved by centrifugal action and the rotation of the other terminal effected by the movement of the fluids in relation to it.

To secure the conditions necessary for the accomplishment of the objects of the invention, various mechanical expedients may be resorted to; but the best and most practicable device for the purpose appeared to Mr. Tesla to be a hollow wheel or drum mounted so as to be rotated at any desired speed and containing a conducting fluid, such as mercury or an electrolyte, which by the rotation of the drum is thrown by centrifugal force outward to the inner periphery of the same, and a sufficient quantity of a lighter non-conducting or poorly-conductive fluid, such as water or oil, which by the centrifugal action is maintained on the surface of the heavier conducting fluid and tends to prevent the occurrence of arcs between the contact-points and the conducting fluid.

A central opening is formed in one side of the drum, through which enters an arm carrying a disc with peripheral projections or vanes which when the drum is rotated project to a sufficient extent toward or into the conducting fluid to effect the makes and breaks of the circuit.

The motion of the fluid within the drum causes the disc to rotate and its projections or vanes to make and break the circuit with a rapidity which may be very great. In fact, when the drum is rotated at a high rate of speed, the fluid conductor may become in its effect similar to a solid body, upon which the conducting disc rolls so that the conducting fluid might be dispensed with.

In order to insure the proper immersion of the projections into the fluid to compensate for wear and at the same time to secure a yielding pressure between the fluid and the disc, it is desirable to employ for the disc some form of spring connection or support which will exert a force tending to force it in contact with the fluid.

Referring to Fig. 4, the various parts are mounted on a base, which contains the condenser, and comprise a transformer with primary and secondary coils, one or more self-induction coils, a small electromagnetic motor D, and the circuit-controller, which is driven by the motor.

The shaft of the motor D extends through a stationary disc E, and to its end is keyed a hollow wheel or drum F, which rotates with it. Two standards G are secured to the disc E and connected by a cross-bar H, from which extends an arm K into the interior of the drum F through a central opening in its side.

To the end of the arm K is secured an arm L, carrying at its free end a disc M with peripheral teeth or projections N. The disc is mounted on any suitable bearings in the arm L, so as to be capable of free rotation.

It is desirable that the disc should admit of adjustment with respect to the inner peripheral surface of the drum, and for this purpose the arm K is secured to a rod O, which passes through supports in the cross-bar H and is adjustable therein by means of threaded nuts P.

The interior of the drum F is tapered or contracted toward the periphery so as to form a narrow trough in which the fluid is confined when the drum is rotated.

R designates the conducting fluid, and S the lighter non-conducting fluid, which are used in the drum. If the proper quantities and proportions of these fluids be introduced into the drum and the latter set in rapid rotation, the two fluids will distribute themselves under the action of centrifugal force around the drum in the manner shown in the figure. The arm K is adjusted so that the teeth or projections on the disc M will just enter the conducting fluid, and by the action of either or both the disc will be rapidly rotated. Its teeth are so arranged that no two are simultaneously in contact with the conducting fluid, but come into the same successively. If, therefore, one part of the circuit be connected to the drum, as by a contact strip or brush T, and the other part to the disc M, or to any part, as the standards G, which are insulated from the frame of the apparatus and in metallic connection with the disc M, the circuit will be made and broken with a rapidity which may obviously be made enormously high. The presence of the non-conducting fluid on the surface of the other operates to prevent the occurrence of sparks as the teeth N leave the latter and also to prevent the current from leaping across the space between the teeth and the conductor as the two approach.

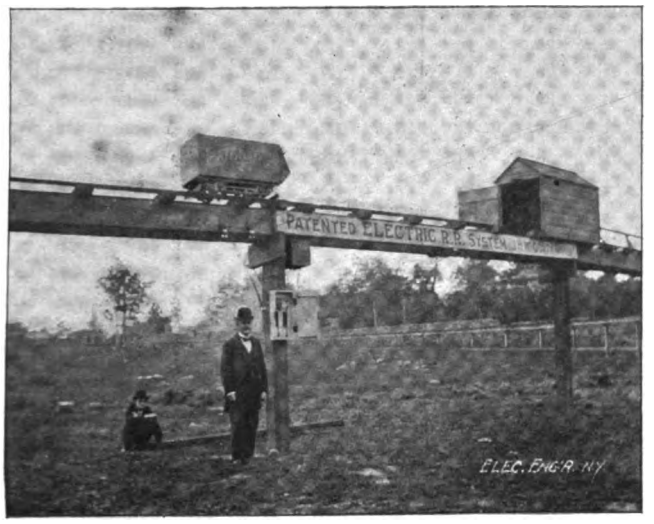
The diagram of circuit connections shown in Fig. 5 will serve to illustrate the purpose and mode of operation of the latest device. Let f f be the conductors from a source of current, each including a self-induction coil C C′ and connected with the arms L and L′ and with two conductors B′ B″, respectively. Then during the periods when the circuit is completed between the two arms L L′ the coils C C′ store energy, which on the interruption of said circuit rushes into and charges the condensers. These latter during the periods when the circuit is closed between arms L and L′ discharge through the primary A′, and induce by such discharge currents in the secondary A″, which are utilized for any purpose for which they may be suited, as in operating vacuum-tubes X or suitable lamps Y. It will be understood that the rotating drum may be mounted in a horizontal or other plane.

Digitized by Google

ELECTRIC TRANSPORTATION

The McGurty High Speed Electric System for Mail and Express Service.

DURING the past few weeks a very interesting series of tests have been carried on at Jersey City Heights with a model car or carrier invented by Mr. J. H. McGurty, of Jersey City. For this purpose a circular track, one-quarter of a mile in length, has been constructed at the corner of Central and Manhattan avenues, and around this track the miniature car speeds



McGURTY ELECTRIC MAIL AND EXPRESS RAILROAD.

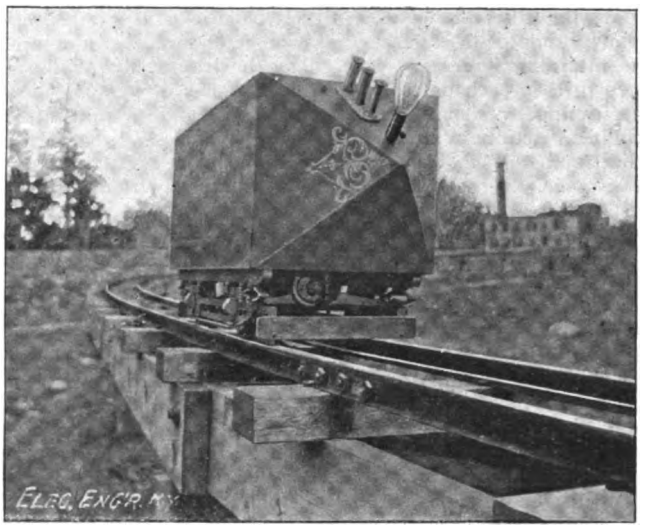
at a marvelous rate, fulfilling the expectations of the inventor and his friends, as well as suggesting the possibility of a commercially successful system of electric express service. The system invented by Mr. McGurty is for the purpose of carrying mail, newspapers and general express matter at a high rate of speed, embodying devices to have the car stop at any desired station and doing away with an attendant on the car. To accomplish these desirable features, Mr. McGurty has invented several new and interesting devices such as automatic controllers, a novel trolley, insulated sections and brake, all of which will be referred to later on.

It is proposed to run the cars at a speed of 120 miles per hour, but the model car shown in the illustrations, which is box-shaped and pointed at one end, is 5 feet long, 3 feet high and 2 feet wide, and weighs 530 pounds, will not run at this speed. It does, however, with 6-inch wheels, attain a speed of eighteen miles per hour on this "continuous curve" track. The practical car will probably be 30 feet in length and have a capacity of about 40,000 pounds.

The inventor, who has carefully worked out every detail of his scheme, claims as new an alternating current motor, one of which is mounted directly on the front and one on the rear axle of the car. On board of the car is an automatic rheostat for starting the car, there being no attendant, and this rheostat embodies a mechanism by means of which the car can be started as slowly or rapidly as is desired, bringing it up to speed in one or two minutes or even a fractional part of one minute. There is further provided an ingenious electric brake which goes into action as soon as the current is applied to it, and is released when the current is shut off. It can be so regulated by springs as to stop the car at a definite predetermined place and any desired time after the current is applied or shut off. An automatic controller is also placed on the car which reduces the speed of the car when turning corners, or down grades, or when approaching stations. This again becomes a vital feature, considering the possibility of derailment or the acquirement of too high a rate of acceleration. There is also provided a switch under the control of an attendant or telegraph operator at the several stations along the route, by means of which the car can be brought to a stop at the required station or caused to pass by it, as desired. This switch is so connected with the conductor or line wire as to cut any section of it out of circuit without interrupting the main circuit and cutting off the supply of electrical energy from other cars at remote points along the line. For this reason the track is divided into as many sections as there are stations along the line, and each station is provided with an insulated circuit breaker for the control of the section at each side of it. The trolley wire, as will be seen from the figure, is supported by a specially designed trolley clip between the tracks, and as the car is intended to run at a high rate of speed, the inventor has adopted a three-wheel trolley which cannot possibly leave the wire.

Having now given a general description of the several devices employed by Mr. McGurty, a general idea of their employment by looking into the method of operation of the system is in order. The cars are sent away by a train dispatcher from one end of the line. He instructs the operator at the station where the car is to be stopped that the car has started on its journey and should be stopped at his station. The operator then throws his station switch, thereby cutting the current off from a section of track near the station. The car, arriving at the station, will find the track in this condition and will automatically have the brakes applied and stop at the appointed place. When it is again ready to proceed on its onward journey the operator opens his switch and the car is started, stopping at any station when so desired or passing through it when no switch is thrown. It is, of course, necessary to use the ordinary block system, allowing only one car to be on any one section at one time; in other words, to have the cars one station apart. It is also necessary to send the "through" cars ahead and have the local cars follow. A car can, of course, be taken out of the line and be returned, the road being double-tracked.

We see, therefore, that all the requirements of a successful express service are fulfilled in this system which, it is claimed, has demonstrated its practicability on a small scale. Mr. McGurty is making further experiments and constantly improving his devices, and hopes soon to have a line constructed between Jersey City and Philadelphia, carrying mail and express matter between these two cities and stopping at a number of intermediate points. Mr. McGurty has been working on this scheme



McGURTY ELECTRIC MAIL AND EXPRESS CAR.

for a number of years, and being an experienced train dispatcher, knows the exacting requirements of a mail or express service. Further developments of his system will be awaited with a great deal of interest by everybody.

BIRMINGHAM, ALA. The Birmingham Railway and Electric Co., having suffered from the frequent theft of its copper wire rail bonds, has given up their use and will rebond the road in conformity with modern and latest practice.

Digitized by Google

Power Consumption in Electric Railroading—II.[1]

BY S. T. DODD.

TO return, however, to the question with which we started—How many pounds of pull does it take to move a train of a certain weight at a certain velocity? The formulæ which steam railroad engineers have developed have been, in some cases, based on hundreds of experiments; but, on account of the widely differing nature of track and train construction, the formulæ differ widely from each other both in their form and in their final results, and without intending to criticise the older branch of railroad engineering, I wish to collect here some of the best known of these formulæ and compare them with readings which we have obtained in electric railroad work.

(1) One of the oldest formulæ with which I am familiar was propsed by Mr. D. K. Clark, and is of the form $(8'' + \frac{V^2}{178})W$. V being the speed of train in miles per hour and W the weight of train in tons of 2,000 pounds.

(2) Another form proposed by Prof. Rankine is of the form

$$\left\{(5.35 + .268 + (V-10)\right\}(T + 2\,E)$$

T being the weight of the train behind the engine and E the weight of the engine and tender. You will note that Prof. Rankine's formula is a straight line, the resistance being proportional to the velocity above 10 miles per hour and a constant quantity below that. He also recognizes the importance of the head resistance, the "pace-making" effort of the engine.

(3) A formula proposed by Mr. W. H. Searles based on his experiments, and of which Mr. Wellington says it has a "wonderful range of application to all speeds, condition and classes of trains," is of the form $4.82\,W + .00535\,V^2W + .0004783\,V^2E^2$.

(4) The most complete and accurate set of experiments with which I am familiar were made by Mr. A. M. Wellington.

The method used by Mr. Wellington, the gravity method, is free from the disadvantages I have quoted, and is as nearly theoretically perfect as we can expect in work of this nature. The method is based on the well known principle that a body moving down a frictionless inclined plane will have acquired the same velocity at any point of the incline as if it had fallen freely through a perpendicular distance equal to the amount of its descent.

Given a train moving at the top of a grade with a measured velocity, if steam is shut off and the train allowed to slide down the grade with gravity as its only accelerating force, and if measurements of the velocity are made at various points on the grade, the difference between these velocities and the theoretical velocity due to the difference of levels will give us a measure of the retarding forces experienced by the train. Mr. Wellington goes further perhaps than any one else has done. He divides the frictional resistance experienced by a moving train into (a) Rolling Friction, or the friction of the journals and that between wheel and rail—a quantity independent of the speed. (b) Head Resistance, or the atmospheric resistance experienced by the first car of the train (c) Side Resistance, or the resistance offered by the atmosphere to the several cars of the train. (d) Oscillating Resistance, or increased journal and rolling friction, depending on the speed.

The formula he develops takes account of all these and is of the form $4W + .28V^2 + .03V^2C + .005V^2W$. C in this formula representing the number of cars in the train.

For sake of comparison I have collected in the table Fig. 2 the results of about twenty observations which I consider the most trustworthy I have been able to get. These observations have all been made on interurban cars running on T rails over a level track at a uniform speed.

In this table the first column gives the number of cars composing the train, the second the speed in miles per hour, the third the total weight of the train, and the fourth the traction co-efficient or horizontal effort per ton of train as calculated from the current consumption. The succeeding columns give the results of the formul which I haveæ which I have already quoted applied to these particular cases. The formulæ themselves are repeated at the foot of the table.

It will be noticed that the formula of Mr. Clark is too low in every case to correspond to these observations. The common fault of the other three formulæ is that the velocity plays too important a part in them. At speeds in the neighborhood of 50 miles per hour their results are too high, and at 25 miles per hour they are too low. This is particularly the case with the formula of Mr. Searles and Mr. Wellington where the velocity enters as the square.

I do not propose to base a formula on the results of about twenty experiments, but, as I have said, these observations are the most trustworthy that I have been able to collect, and it may be of interest to try and find a formula which shall combine their results more nearly than those that have been already proposed. By plotting these results I have decided on the following formula as expressing as nearly as possible the results of these observations.

For a single motor car weighing E tons, pulling trailers weighing T tons, the resistance due to the motor car is $(18 + .2V)E$ and that due to the trailers is $(7 + .2V)T$. The results of this formula have been worked out in the last column,

TRAIN RESISTANCE

COMPARISON OF OBSERVATION AND FORMULAE

No. of Cars	Speed of Train	Weight in Tons	Res. per Ton	Clark	R'kn'n	S'rls	Well	
1	25.9	20	23.5	11.7	18	14.8	17.7	23.2
1	28.	21	22.	12.4	20.3	16.8	19.5	23.6
1	32.	20	25.	13.8	22.5	19.8	25.	24.4
1	34.	21	25.7	14.4	23.5	22.6	26.8	24.8
1	36.	21	28.3	15.2	24.7	24.8	29.6	25.2
1	43.	20	27.	18.3	28.4	32.4	42.	26.6
1	45.5	20	27.7	19.6	29.6	35.4	46.	27.
1	47.	20	28.	20.3	30.5	37.8	49.	27.4
1	47.5	20	27.3	20.6	30.75	38.5	50.	27.5
1	49.5	20	25.	21.7	35.9	41.4	54.	27.9
2	27.	35	17.7	12.1	15.5	12.7	14.7	18.7
2	39.	35	20.3	16.5	20.5	21.5	25.5	21.1
2	40.	35	25.	17.	21.	22.	27.6	21.3
2	40.25	35	20.25	17.1	21.2	22.3	27.8	21.3
2	42.25	35	22.3	18.	22.	24.1	30.7	21.8
3	25.	50	16.	11.5	13.1	10.5	11.7	16.4
3	34.5	50	20.	14.6	16.7	15.7	18.8	18.3
3	37.6	50	18.5	15.9	17.9	17.7	21.5	18.9
6	31.8	95	18.3	13.7	11.2	12.25	14.	15.7

Clark $\left(8 \times \frac{V^2}{178}\right) \times W$

Rankine $\{5.35 + .27\,(V\,10)\}\,(T + 2\,E)$

Searles $4.82\,W + .005357\,V^2\,W + .0004783\,V^2\,E^2$
(Head) (Side) (Oscillation)

Wellington $4\,W + .28\,V^2 + .03\,V^2\,C + .005\,V^2\,W$

Proposed $(18 + .2\,V)\,E + (7 + .2\,V)\,T$

V — Speed in Miles per Hour
C — Number of Cars in Train
E — Weight of Engine or Motor Car in Tons of 2000 Lbs.
T — " " Trailer Cars " " " " "
W — " " Whole Train E + T

Elect. Eng'r. N. Y.

FIG. 2.

and by comparing with the observations in column 4 they will be seen to give a very fair agreement.

In conclusion to this part of the subject, I would say that as far as my own observations go, for ordinary interurban cars running on straight and level T rails, with roadbed of modern construction, the formula $(18 + .2V)E + (7 + .2V)T$ expresses very fairly the train resistance between 25 and 50 miles per hour, and while I do not mean to say these experiments are exhaustive, I hope this statement may be of assistance to other observers in collecting and stating the results of their observations.

[1]A paper read before the Civil Engineers' Club, Cleveland, Ohio.

Fresh-Air Work by Electricity.

A MAN who is prominently identified with the banking and street railroad business of Brooklyn did some "fresh-air work" recently which fas highly satisfactory and, as he said, demonstrated that there were more ways of doing good than "buying paper dolls for blind babies." "We had heard of the illuess of a woman and her little one," said the fresh-air man, "and that there was little hope for the recovery of the mother. Everybody felt sorry, and all sorts of plans were suggested for making the poor woman more comfortable. Baskets containing dainties were sent, and boxes and bundles of more dainties followed. I

Digitized by Google

proposed fresh air, and went to work at once to secure it. I had a wire run from the electric line near our house, in Monroe place, to the sick chamber, had an electric fan placed at the foot of the invalid's bed, and my fresh-air scheme reduced the patient's temperature in a short time, and the doctor thinks it may have had much to do with her improved condition. There must be many places in this large city during the extreme weather where a similar gift would do much good, and for that reason I am anxious to have people know about my 'fresh-air' scheme."

NEWS & NOTES

The Modern Round House Turn-Table—The Westinghouse Electric "Donkey."

THE economies of railway management do not end with the adoption of the high-pressure compound locomotive, or the hundred other contrivances which have been born of necessity, but go on and on, always finding a way to eliminate here or there an unnecessary expenditure. The latest economic development is the adaptation of the electric motor to turn-tables, called the Westinghouse turn-table "donkey." The simplicity of the device and the method of operating it is plainly evidenced in the illustrations. It is the product of the Westinghouse Electric and Manufacturing Company, and consists of their "series reversible" 10 h. p. motor, mounted within a heavy cast-iron frame, having a traction wheel which rests upon the rail of the turn-table pit. Power is transmitted to this wheel through double reduction gears. The "donkey" frame is connected by drawbar and pin to one end of the turn-table at the side, sufficient traction for the driving wheel being secured through the weight of the machine, which is 3,700 pounds. Wires are run from the "donkey" to a small platform, located at one side of the centre of the turn-table, or other convenient place, at which point is installed a controlling rheostat. By means of this controller the "donkey" may be operated in either direction and its speed controlled at will by simply moving a single lever to one or the other side of a neutral point. Current which may be supplied from the shop lighting or other convenient circuits, and may be either alternating or direct and of any standard voltage, is supplied by wires brought to a suitable contact overhead and then led to the controller.

As no changes in the turn-table are required for installing the turn-table "donkey," the connections between frame of the latter and the turn-table girder being very simple, the cost of installation is low. As compared with the steam-operated turn-table, it is apparent, even to the layman, that electrical power has the advantage, as it is a well-recognized fact that the small portable boiler and engine are extremely wasteful of fuel, besides being a source of danger and requiring constant expert attention.

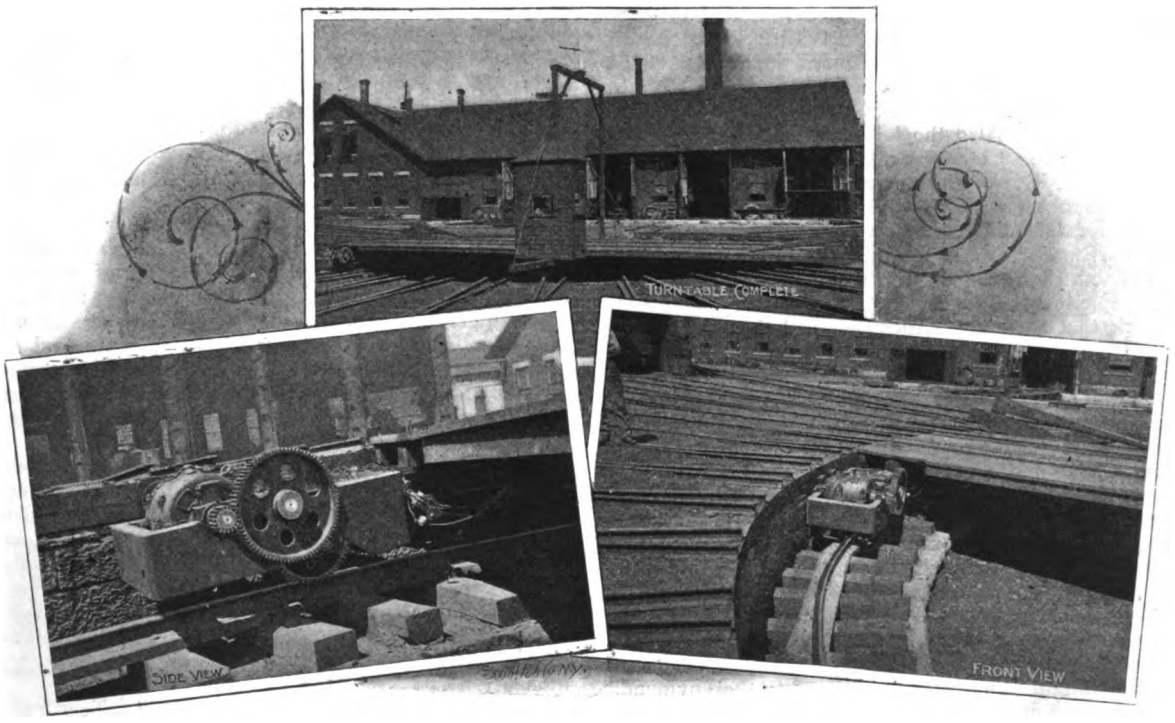
The comparison with turn-tables operated by push poles is no less interesting. In one of the installations, located at an important division point, it was necessary to turn 176 engines each twenty-four hours, or about 7 per hour. Previous to installing this "donkey," push poles were used, requiring the services of four men, and the operation was a slow one at best. Now one man does the work in a much shorter time. With turn-table "light," the "donkey" will make a complete revolution in 30 seconds, while with a ten-wheel locomotive on the table, weighing, with tender, 100 tons, a complete revolution is made in 45 seconds. We therefore have the following summary:

Engines turned per day	176
Men required	4
Average time, each man	5 min.
Total time per engine (5 min. × 4 men)	20 min.
Total time for 176 engines	59 hrs.
Total time for 176 engines with electric donkey	24 hrs.
Time saved	35 hrs.
35 hours at 12½c., amount saved per day	$4.37

The above calculations assume that the men are employed in wiping engines while not employed in operating turn-table; otherwise the comparison would be still more favorable to electrical operation.

The assumption of five minutes per man on the average is conservative. It is plain that the 35 hours saved would supply two day and two night men as wipers on shifts of 8 hours each.

It is stated that actual tests have shown that the power consumed by the electric "donkey" is the equivalent of one-half h. p. per hour. Assuming 6 pounds of coal per h. p. with coal at $2 per ton, the cost of turning each locomotive would be 3-10 cents, or 53 cents for 176 locomotives.



VARIOUS VIEWS OF THE WESTINGHOUSE ELECTRIC TURN TABLE.

Digitized by Google

ELECTRIC LIGHTING.

Fourth Annual Meeting of the Ohio Electric Light Association.

A HIGHLY successful meeting of the Ohio Electric Light Association, being the fourth annual, was held at the West House, Sandusky, O., when a number of good papers and of pleasant excursions were greatly enjoyed by a large gathering of members and friends, inclusive of several ladies.

Among those present at the Ohio Electric Light Association meeting were: W. B. Chapman, Akron St. Ry. & Ill'g Co.; E. H. McKnight, Bowling Green El. Lt. & P. Co.; H. A. Schlicht, secy., Bellevue Lt. & P. Co.; H. C. Fogle, supt., Canton Lt. Ht. & P. Co.; J. M. Plaisted, supt., J. Q. Brown, secy., Columbus Elec. Co.; A. W. Field, secy., Columbus Edison El. Ill'g Co.; Sam'l Scoville, M. E. Turner, Cleveland El. Ill'g Co.; W. F. Raber, Citizens' El. Ry., Lt. & P. Co., Mansfield, O.; E. F. Gwynn, gen. mgr., Delaware El. Lt. & P. Co.; Albert Thomas, supt., Dayton El. Lt. Co.; C. Schwartz, mgr., Fostoria Lt. & P. Co.; A. F. Dickinson, pres., Geneva El. Lt. Co.; D. L. Gaskill, pres., H. C. Ayres, supt., Greenville El. Lt. & P. Co.; C. Smith, Hancock Lt. & P. Co.; M. Cook, Hillsboro Lt. & P. Co.; W. D. Packard, secy., Robt. E. Gorton, P. A., D. W. Low, Jefferson Lt. & P. Co.; Thos. Espy, pres., Frank Espy, electrician, Kenton Gas & El. Co.; George Mott, pres., Lancaster El. Lt. Co.; John E. Townsend, supt., Lima El. Lt. & P. Co.; B. P. Foster, secy., Northern Gas & El. Co., Norwalk; L. Culver, supt., Northern Gas & El. Co., Norwalk, O.; Dr. A. G. Henry, pres., No. Baltimore El. Lt. & P. Co.; H. K. Wood, pres., S. M. Rust, supt., Piqua El. Co.; E. S. Trussell, gen. mgr., Pomeroy & Middleport El. Co.; John H. Miller, supt., Springfield Lt. & P. Co.; Emil G. Schmidt, gen. supt., H. N. Sloat, electrician, Sandusky El. Lt. Co.; W. S. Smith, E. G. Bechtol, Toledo El. Co.; C. E. Inman, supt., Warren El. Lt. & P. Co.; W. F. Hubbell, Wauseon El. Co.; B. P. Holmes, gen, mgr., Youngstown El. Lt. Co.; S. Griffin, pres., Lake Erie El. Lt. Co., Lorain, O. Also the following supply people: F. A. Kelly, Gen. El. Co., Cincinnati; H. W. Hillman, Gen. El. Co., Schenectady, N. Y.; W. F. Hayes, Gen. El. Co., Cincinnati; C. J. Wells, Chicago; D. W. Low, Packard Lamp Co., New York; Geo. C. Kunz, Bradford Belting Co., Cincinnati; H. E. Adams, Illinois El. Co.

President Wood, of Piqua, O., made a brief but earnest and witty address opening the convention, in which he emphasized the good work that such an Association had done and could do, in such matters as the municipal plant agitation and in the interchange of ideas and experiences. The growth of the Association had been as follows: 1895, members 37; in 1896, 43; in 1897, 49; and 1898, no fewer than 61. He said: "The outlook for the near future opens up with interest and promise to all of us. With the improvement in business which will soon follow, the demand for more light and power will be made upon us, and we should prepare our stations to meet the demand in a way that will reflect credit upon the light and power furnished, thereby giving satisfaction to the customer and profit to the stockholder." After thanking his fellow officers and the Executive Committee, he declared the fourth annual convention open.

Among the papers read was an excellent one by Mr. C. D. Haskins, of Boston, on "The Meter's Relation to the Dividend," dealing with the selection of meters, their installation, questions of temperature, maintenance, testing, cleaning and inspecting. He also discussed the two-rate system and the prepayment meter.

Mr. M. E. Turner, of Cleveland, O., read an admirable paper on "Some Suggestions Relative to Determining the Cost of Electric Supply," in which he developed the "Wright Demand Method" of charging a consumer for current, showing that it was based on the proportioning of all expenses into those which are fixed and those which vary with the output of the station. He went into these different expenses with great detail and minuteness.

Mr. Ernst J. Berg read a very suggestive paper on the "Long Distance Transmission of Power," devoted chiefly to questions connected with the combination of power transmission for incidental motor load, and with transmission for lighting, considering these under their various aspects. Matters of proper frequency were discussed and arguments were put forward in favor of single phase distribution.

Mr. J. H. Perkins read a paper on "Comparative Commercial Qualities of Old and Modern Transformers as Applied to an Exchange." The figures shown as to the saving effected were remarkable, typical, actual cases being taken.

Prof. E. P. Roberts presented a careful study of "Positive and Negative Economies in the operation of Small Electric Light Plants." Many points of possible economy and of beneficial change were brought out.

The discussions throughout the meeting were pertinent and interesting.

The following officers were elected for 1898-9: President, Emil G. Schmidt, Sandusky, O.; vice-president, B. P. Holmes, Youngstown, O.; secretary and treasurer, Samuel Scovil, Cleveland, O. Executive Committee—H. K. Wood, Piqua, O.; B. P. Foster, Norwalk, O.; George Matt, Lancaster, O.; E. H. McKnight, Middletown, O.; S. Griffin, Lorain, O. Finance Committee—Albert Thomas, Dayton, O.; Thomas Espy, Kenton, O.; Jno. E. Townsend, Lima, O.

Cleveland was chosen as the place for the next meeting, the date to be fixed by the Executive Committee.

The usual resolutions of thanks were adopted, and a tribute was paid to Mr. Wood, the retiring president. The meeting was the best that the Association has ever had.

The New Welsbach Incandescent Lamp Filament.

THE German Journal for Gas Lighting of recent date—reports Consul General Mason, of Frankfort, Germany—contains some highly interesting information upon what is perhaps the most important new topic in the science of illumination, namely, the improved incandescent filament for electric lamps, which has just been announced by Dr. Auer von Welsbach, the distinguished inventor of the incandescent gaslight which bears his name. It was but natural that, having perfected the device which increases so remarkably the illuminating power of gas, Dr. von Welsbach should seek to develop some similar improvement for the application of electrical currents to illuminating purposes.

This, he appears, from the somewhat meagre published accounts, to have found in a filament of osmium, one of the rare metals, which, besides being the densest of all metals, is the most refractory, being infusible at any except the highest attainable temperatures. Osmium is found native as an alloy in certain ores of platinum and iridium. It is a hard, bluish-gray metal, with an atomic weight of 191.1, and the enormous specific gravity of 22.477, the heaviest substance known. Its tetroxide has a strong odor of chlorine, from which circumstance its name was originally derived.

But the property which must have suggested osmium as the material of the new electrical filament was its practical infusibility, its known resistance to temperatures in which platinum and iridium volatilize and disappear. It is well known that the intensity of light emitted by an incandescent substance increases rapidly with its absolute temperature. By heating osmium in a vacuum with an electrical current strong enough to volatilize platinum, it attains a luminosity hitherto almost unknown, emitting a white light of agreeable quality and color, but of great intensity.

So far as can be inferred from what has been published, the experiments of Dr. von Welsbach go quite beyond the employment of a naked osmium filament, and include coating the metal with a refractory oxide like thoria.

It has long been known that a platinum wire or filament, through which a sufficiently strong current is passed, attains a white heat and then suddenly melts. If, however, the filament be coated with a highly refractory oxide like thoria, the temperature required to melt it is greatly increased, for the reason that part of the electrical energy is withdrawn from the metal to its oxide coating and is radiated in the forms of light and heat. Precisely the same result happens when the filament coated with oxide is of osmium, instead of platinum, and the

Digitized by Google

resistance of the filament is still further increased to the extent that osmium is in itself more infusible than platinum.

There is thus obtained a filament capable of sustaining a temperature and consequent intensity of illumination hitherto unachieved by such means, and it is this which forms the germ of the present invention of Dr. von Welsbach. It has been noted in his experiments that osmium used for this purpose must be almost chemically pure, and that commercial forms of that rare and costly metal require, before using, to be cleansed as far as possible of all impurities except platinum, a small admixture of which renders the osmium more elastic without sensibly diminishing its infusibility. The whole effect of the invention, if practically applied, will be to advance in an important degree the limit of electrical energy which may be used in incandescent lighting and thus reach a new standard of economy in the production of artificial light, which is cheapest at the intensity obtainable only at high temperatures.

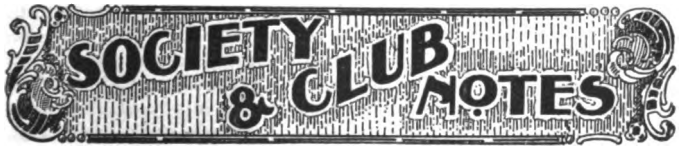
Osmium, according to the trade catalogue of a leading German chemist, costs $1.10 for 20 grains; so that if the new filament should become successful in general use, there will be a demand for a larger supply of that metal at a more moderate price.

The Economical Carboning of Arc Lamps.

BY W. J. CLARKE.

FOR some unaccountable reason it seems that but few lighting stations are aware of the fact that it is possible to reduce greatly their operating expenses by giving proper attention and study to the carboning of the arc lamps. The large majority of the stations have for years been using double carbon lamps, in order that it may be possible for them to operate the lamps all night, or for two nights where the lights are extinguished at midnight. Now it is quite possible to give just as good if not better results by so carboning the lamps that a double lamp will run two whole nights of 14 hours each, and in this way it will be readily seen that the number of trimmers will be reduced one-half, on account of the fact that while one man can carbon, say 50 lamps per day, where each lamp will only burn one night, it is quite possible for the same trimmer to carbon just double the number of lamps if they are so carboned as to burn two whole nights. This reduction in trimmers is accomplished by each man taking a circuit of 100 lamps instead of 50, and carboning one-half of them each day.

It may at first seem strange that the number of hours that an arc lamp will burn may be nearly doubled by a slight change in the carboning as well as in the current; but the writer has proved again and again by practical experience that this can be quite readily accomplished, by using five-eighths-inch plain carbons in the upper holders and one-half-inch copper-coated carbons in the lower holders, and then reducing the current on the line from 9½ to 9 amperes. It will, of course, be necessary as soon as this is done to alter slightly the adjustments of the lamps, but the larger carbon in the upper holders has the effect of giving the appearance of a much steadier and stronger light than formerly, so that the city authorities usually consider that the service has been greatly improved just as soon as the change has been made.



Sixth Annual Meeting of the Society for the Promotion of Engineering Education.

THE sixth annual meeting of the Society for the Promotion of Engineering Education was held in Room 22 of the Walker Building, Massachusetts Institute of Technology, Copley square, Boston, Mass., on August 18, 19 and 20, 1898.

After a meeting of the council at 9 a. m. on Thursday, August 18, the general meeting was called to order at 9:30 by President John B. Johnson, Professor of Civil Engineering, Washington University. After the routine business had been disposed of, such as the reports of officers and election of members, the president read his address, entitled "A Higher Industrial and Commercial Education as an Essential Condition of Our Future Material Prosperity."

The following papers were then read: "The Mutual Adjustment of Class-room and Laboratory Instruction," by Prof. Gaetano Lanza; "The Mounting of a Spherical Blackboard," by Prof. A. E. Haynes, and "Notes on the Organization of an Engineering Laboratory," by Prof. H. B. Smith.

Thursday afternoon was devoted to sightseeing and a number of excursions and trips of inspection were indulged in by the members and their friends.

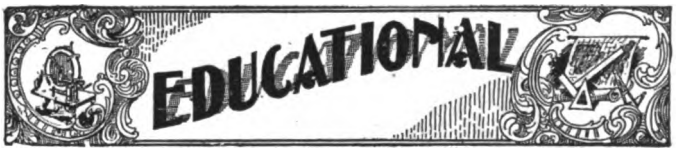
In the evening an interesting paper was read by Prof. R. H. Thurston on "The Correct Theory and Method of Organization and Conduct of Professional Schools." The committee on entrance requirements, of which Prof. H. W. Tyler is chairman, made their report.

On Friday morning after business had been transacted, the members listened to the following papers: "Some Phases of Engineering Education in the South," by Prof. J. J. Wilmore; "The Study of Electricity in Courses Other than Electrical," by Prof. J. P. Jackson; "A Course in Industrial Chemistry for Technical Schools," by Mr. F. L. Dunlap; "A New Laboratory Apparatus for Illustrating Longitudinal Impact," by Prof W. K. Hatt.

The afternoon was devoted to sightseeing and in the evening the following papers were read: "The Direct Study of Thermo-dynamics," by Prof. S. A. Reeve; "Laboratory Instruction in Electrical Engineering," by Prof. R. B. Owens; "A Course in Highway Engineering for Civil Engineers," by Prof. W. R. Hoag; "Notes on Some Methods in Use in an Engineering Laboratory," by Prof. F. C. Caldwell.

The session was resumed on Saturday morning when these papers were read: "The Claims of Sanitary Science to a Place in the Curriculum of Engineering Education," by Prof. W. T. Sedgwick; "Undergraduate Thesis Work," by Prof. Edgar Marburg; "The Construction of Models by Students as an Aid in Teaching Descriptive Geometry," by Assoc. Prof. Henry S. Jacoby, and "The Training of Engineers for the Maintenance of Way Department on Railroads."

A business meeting was then held at which committees were appointed and officers for the ensuing year were elected. The attendance was excellent and the papers were ably discussed. The meeting was adjourned sine die on Saturday afternoon, August 20.



Electrical Course at Pratt Institute.

We wish to call attention to the admirable work done in the science and technology department of the Pratt Institute, Brooklyn, N. Y., in their two-year courses in drawing and machine design and applied electricity. They are filling a want that has for a long time been felt in the field of technical education. Their courses are not intended to train expert engineers or specialists and their students are men who have had but little previous theoretical knowledge and cannot pass the difficult mathematical entrance examinations that are required by the higher educational institutions.

They start with low requirements for admission and in two years give their students a thorough training in the theory and practice of mechanical and electrical work, of which the record of their graduates is ample proof. Mr. Arthur L. Williston is director of the department and has brought the same up to a high standard of proficiency. We also take this opportunity of commenting on the excellent evening courses which have been inaugurated at the Pratt Institute in which carpentry, machine work, plumbing and painting are taught for the insignificant tuition fee of $15 for six months. There are also evening classes in mechanical drawing, mechanism, physics, chemistry, applied electricity and the steam engine, for which a tuition fee of $5 is charged for a course covering a period of three months. Circulars giving information on these various courses will be gladly sent to any one on application to the director of the department.

Digitized by Google

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued August 9, 1898.

Batteries, Secondary:—

PLATE FOR SECONDARY GALVANIC BATTERIES AND COMPOSITION FOR PRODUCING SAME. Carl Marschner, Berlin, Germany, 608,614. Filed Sept. 30, 1896. An exterior lead frame and a filling composed of an active material, such as lead oxid, and a binding medium, such as amber.

STORAGE BATTERY. John D. Rively, Pittsburg, Pa., 608,714. Filed June 9, 1897. Consists in an outer box or casing having a series of positive and negative plates arranged therein and provided with a fiber or other suitable backing, which serves to form a spongy substance to retain the acid stored in the same, and serves to keep the plates in a moist state.

Conductors, Conduits and Insulators:—

INSULATION OF ELECTRIC WIRES. Joseph A. Poche, New Orleans, La., 608,906. Filed June 22, 1898. An insulation for conductors carrying currents of high potential, consisting of a surrounding insulating-sleeve and two inclosing glass cones, retained by a collar at one end and a nut at the other.

ELECTRIC CABLE. Henry A. Reed, Newark, N. J., 608,911. Filed Oct. 24, 1896. A conductor with an insulating covering and a sheathing or armor consisting of spirally laid wires of non-magnetic metal.

Dynamos and Motors:—

ELECTRIC MOTOR. William H. Powell, Erie, Pa., assignor to the Keystone Electric Co., of Pa., 608,711. Filed Nov. 4, 1897. A device which prevents the sudden rush of current through the motor-armature at starting, and to secure all the necessary starting torque with a current not greater than the normal working current of the motor; also, to combine all the advantages of a compound and a shunt motor by running as a compound machine at starting.

Electric Heating:

ELECTRICAL COOKING APPARATUS. John B. Cary, Baltimore, Md., assignor of one-half to Marie Clothilde Delavy, Baltimore, Md., 608,952. Filed March 14, 1898. Combination of two boxes each one having therein heating wires and a corrugated tray situated over the wires, and strap-hinges, one member of which is adjustably attached to a box whereby the boxes may be separated and held in a separated position.

Electro-Chemistry:

APPARATUS FOR HEATING AIR FOR THERAPEUTIC OR OTHER PURPOSES. William Taylor, Edinburgh, Scotland, 608,928. Filed Dec. 21, 1897. The apparatus comprises means for imparting motion to the air or gas, combined with means for heating it.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. Thomas Spencer, Philadelphia, Pa., 608,723. Filed Sept. 29, 1897. Enclosed arc lamp having its inductance reduced when lamp is started. Solid carbons can be employed. It has a novel clutch and is adapted for alternating currents.

Measurement:

ELECTRIC METER AND MOTOR. Harry P. Davis, Pittsburg, and Frank Conrad, of Wilkinsburg, Pa., assignors to the Westinghouse Electric and Mfg. Co., Pa., 608,842. Filed June 18, 1898. A simple and efficient means whereby a shifting magnetic field may be produced and employed for actuating an armature or secondary member having circuits closed upon themselves and located in such magnetic field at a speed which is proportional to the energy in the circuit with which it is connected.

Miscellaneous:—

ELECTRODYNAMIC APPARATUS FOR OPERATING CLIPPING, BRUSHING OR OTHER MECHANISMS. Warren P. Freeman, New York, assignor to Robert J. Campbell, same place, and Francis Larkin, Jr., Sing Sing, N. Y., 608,768. Filed Aug. 12, 1897. An electrically actuated clipping mechanism, consisting of an electric motor, the field magnet of which forms a casing within which the operating parts are contained.

APPARATUS FOR STORING AND USING SOLAR HEAT. Henry F. Cottle, Boston, Mass., assignor of two-thirds to William Calver, Washington, D. C., and John J. Pratt, Revere, Mass., 608,755. Filed Dec. 11, 1897. Concentrating the sun's rays and causing them to fall upon a suitable heat receiving and retaining body, such as a pile of stones, and then causing the stored heat from said body to fall upon a thermo-electric generator, which converts the energy of heat into energy of electricity, and finally utilizing the electric energy in any suitable manner.

WIRE STRIPPING TOOL. Leroy A. Sell, Philadelphia, Pa., assignor of one-half to Meredith O. Sullivan, same place, 608,919. Filed July 8, 1896; renewed Jan. 26, 1898. A tool consisting of two jaws linked together which grips the wire and strips off the insulation as the wire or support are moved longitudinally in relation to one another.

GENERATOR FOR ELECTRICAL IGNITERS. Benjamin McInnerney, Omaha, Neb., assignor to the McInnerney Mfg. Co., same place, 608,895. Filed March 30, 1898. The combination with the shaft, flywheel and electrical igniter of a gas engine, of a yoke swinging upon a bearing, arms extending from the yoke, a permanent magnet and core carried by one of the arms, stop devices limiting the movement of the other arm, and keepers carried by the flywheel.

GENERATOR FOR ELECTRICAL IGNITERS. Benjamin McInnerney, Omaha, Neb., assignor to the McInnerney Mfg. Co., same place, 608,896. Filed March 30, 1898. Similar to above.

STEAM WHISTLE. Forlest A. Davey, Detroit, Mich., assignor of one-half to John G. Patterson, Detroit, Mich., 608,955. Filed June 1, 1897. A specially constructed steam whistle, with an electro-magnet attached to pipe and valve for operating it.

Railways and Appliances:—

SUPPORTING CLIP FOR OVERHEAD ELECTRIC CONDUCTORS. William A. Bartley, Boston, Mass., 608,637. Application filed May 23, 1898. Two separable interlocking members, one of which is arranged to be forced into operative position after the wire is put up, so as to clamp and support it in conjunction with the fixed member.

BOND FOR RAILS. George A. Weber, New York, N. Y., 608,736. Filed Feb. 7, 1898. A bond formed with end portions and a thickened or enlarged part intermediate its ends.

Regulation:—

AUTOMATIC ELECTRIC REGULATOR. Robert Skeen, St. Louis, Mo., 608,721. Filed Oct. 23, 1897. For cutting out automatically one or more devices in a circuit, so as to utilize the available current to operate to full or nearly full efficiency the remainder of the series, and likewise to restore such cut-out devices when the current rises to the predetermined voltage.

Switches, Cut-Outs, Etc.:—

LIGHTNING ARRESTER. John F. Kelly, Pittsfield, Mass., assignor of one-half to Cummings C. Chesney, Pittsfield, Mass., 608,685. Filed Dec. 16, 1895. A lightning arrester consisting of a column of conducting or semi-conducting bodies in bad contact with one another, as a whole practically non-conducting under ordinary electric stress, but under high stressss conducting.

SWITCH FOR VARYING ELECTRIC RESISTANCE. Eduard F. H. H. Lauckert, London, Eng. Assignor to Siemens Brothers & Co., Ltd., London, England, 608,878. Filed Nov. 29, 1897. A switch for varying electrical resistance, consisting of a series of conducting-segments connected by successive resistances, and two or more brushes connected to move together but insulated from each other and electrically connected through a resistance.

Telephones:—

TELEGRAPH REPEATER. Henry P. Donnelly, Cincinnati, Ohio, 608,846. Filed June 23, 1897. A mechanism to be employed at a station intermediate of two signaling-stations and to act as a repeater or relay to automatically transmit the signals, thus shortening the length of line operated by one battery.

TELEGRAPHY. George V. Trott, Chicago, Ill., assignor of one-half to Ella M. Cozens, Chicago, Ill., 608,932. Filed Aug. 13, 1897. Railway telegraph system wherein telegraphic instruments may be employed upon moving vehicles to transmit and receive signals.

LEGAL NOTES

An "Accident" From Stealing Trolley Rides.

Judge Pennypacker, of the Common Pleas Court, Philadelphia, has handed down an opinion adverse to the interests of small boys who steal trolley rides by hitching on behind. The facts were that Louis Feingold was stealing a ride upon a car of the Philadelphia Traction Company in September, 1895. He had seated himself upon the side step of a summer car, and the conductor observing him from the middle of the car, motioned with his finger and told him to get off. The boy became frightened and fell off while the car was in motion and was run over, a wheel cutting off his foot. Suits were then begun to recover the damages, and at the trial the court instructed the jury to find a verdict for the railroad company. Motions for new trials were made, and it was upon these motions that the decision was rendered. The plaintiffs' counsel contended that it was the duty of the conductor to stop the car and see to it that the plaintiff was put down gently and in such a way that he could not hurt himself.

Judge Pennypacker in his opinion says: "Is there such a duty? We know of no Pennsylvania case which has so held, and the principle does not commend itself to approval. However meritorious it may be to save children and others from impending danger, we are not required to offer our aid under penalty of damages for refusal. To hold that such a duty exists is in effect to say that the cars are run for the benefit of trespassers. To require the stopping of a car in order to put off intruders might be upon certain occasions a great embarrassment to both the company and its passengers. A school of trespassing children could lawfully stop the running of a railroad. The true rule would seem to be that deduced from our cases, and upon which the most of them can be reconciled, that force, or that which is tantamount to it, cannot be used to the injury of child trespassers, but that the responsibility for care over them rests with their parents and guardians."

Damages for Passenger on Electric Car Frightened by Flashes.

OLGO PAULSEN, while a passenger with her niece, twelve years old, upon an open trolley car of the Nassau Electric Railroad Co., Brooklyn, N. Y., becoming alarmed by the flashing from the controller or motor box situated at the front railing of the car, jumped from the car while it was in motion, and fell to the ground, breaking her leg and receiving other severe injuries. In an action brought by her against the railroad company to recover for such injuries, there was evidence tending to show that the flashing was of an unusual character; that the controller was out

Digitized by Google

of order, a fact which was easily discoverable, and that the car had not been inspected before it left the depot on this trip. A judgment on a verdict given on the trial for plaintiff for $7,500 was unanimously affirmed by the Second Appellate Division in an opinion by Presiding Justice Goodrich. The court held that the question of the defendant's negligence was properly submitted to the jury, and that the judgment should not be disturbed. It was held that negligence might also be imputed to the railroad company from the fact that the motorman, after the flashing or flaming began, permitted the car to continue its course, without stopping to ascertain the cause of the flame, until a new element of apprehension was reproduced by the burning of the fuse.

Purchase of Municipal Lighting Plant.

A debt for the purchase of an electric light plant for a municipal corporation is held, in Mayo vs. Washington (N. C.), 40, L. R. A. 163, not to be one of the "necessary expenses" of the town which can be incurred without a vote of the majority of the qualified voters and legislative authority.

Responsibility for Flywheel Accident.

In the autumn of 1895 a flywheel, eighteen feet in diameter, in the power house of the Albany Railway in the city of Albany, burst or fell to pieces, while in motion, and one of the fragments killed a young man who was in a saloon on the opposite side of the street. In a suit brought to recover damages on account of his death, the Appellate Division of the Supreme Court in the Third Department has just held that the mere fact of the explosion of the wheel was not presumptive evidence of negligence on the part of the owners operating it. The wheel had been purchased directly from the manufacturers and had been safely used for two years. "Some injuries are of such a nature," says Mr. Justice Landon, who writes the opinion, "that the first thought that occurs to the mind is that nothing but carelessness or wilfulness could have produced them." But he thinks that the bursting of a flywheel does not fall within that class. "The explosion does not, in fact, speak for itself and tell us the cause. To punish the defendant because it cannot explain the cause of the explosion is not to punish it because it has done wrong, but may be because it does not know what we wish to find out." In the language of lawyers, the res ipsa loquitur, "the thing itself speaks," is said to apply to those cases in which negligence is inferred simply from the occurrence of the accident.

CINCINNATI, O. The B. C. A. has rejected the bill for the $20 fees for the membership of ex-City Electrician Cabot, in the National Electric Light Association.

THE STOCK MARKET

Confidence.

The past week has witnessed an intensification of the conditions making for betterment. Bank clearings showed a gain over a year ago of 11 per cent., and 56 per cent. over 1896. Railroad reports are good, Burlington & Quincy increasing its dividend rate to a 6 per cent. basis. Wheat shipments are larger than last season, and crops are excellent. Trade in every section is waking up rapidly under a good Fall demand, and the iron and steel industry is on a boom. Best of all, there is peace.

The stock market has faithfully reflected the improvement, and after enormous transactions and reactions, became steady at a much higher range of prices. On sales of 62,974 shares Western Union went up to 95⅞ and stayed thereabouts. General Electric reached 42 and closed at 41⅛, on sales of 9,115 shares. New York Edison reached 133. In Boston, American Bell Telephone went up to 284 and closed at 282. West End Railroad closed at 87½. New York Metropolitan Street Railway closed at 159½, but Manhattan fell off, closing at 100½. There were rumors of its coming purchase and electrification by the Metropolitan.

REPORTS OF COMPANIES

General Electric Stock Scaled Down Twenty Millions.

At Schenectady, N. Y., on Aug. 17, the reduction of the capitalization of the General Electric Company was effected at the adjourned stockholders' meeting without any considerable opposition. Mr. T. Jefferson Coolidge, seconded by M. Phelan, made a motion in the form of a resolution, declaring that the capital stock of the General Electric Company be reduced from the present amount to $20,827,200, which shall consist of 182,760 shares of common stock, par value $100, and 25,512 shares of preferred stock, par value $100, the now existing common and preferred stock and the number of shares of each holder being respectively reduced to three-fifths of the present amounts.

Mr. W. L. Putnam, representing the minority preferred stock, moved to adjourn and await the result of the Livermore litigation. The motion was put to a stock vote and lost—243,141 to 9,800. Mr. Putnam also attempted to have a committee appointed to appraise the true valuation of the property, but Messrs. Coolidge and Ames affirmed their reliance on the Board of Directors, who had carefully considered the matter, and this amendment was also lost.

Mr. Putnam protested that the vote was illegal, for four reasons: First, because the charter did not authorize the reduction; second, because such reduction would practically take 40 per cent. from the value of the preferred stock and give it to the common stock; third, because the common shares had been largely overissued and had remained unpaid; fourth, because there was no sufficient justification for reduction on any grounds whatever. Finding that the tide of the reduction movement was too strong to be resisted, Mr. Putnam finally succumbed with a last attempt to have the vote declared void.

President Coffin overruled all these objections. The sworn tellers made their report through Mr. Darling, their chief. President Coffin declared that 243,141 votes were cast in favor of reduction and only 9,800 against it.

ELECTRIC STORAGE BATTERY CO., of Philadelphia, did a business in July, it is stated, of $200,000, and August is expected to exceed that figure.

CATALOGUES.

Chas. J. Bogue's Marine Projectors and Searchlights.

A number of small pamphlets are being sent to the trade and interested parties by Chas. J. Bogue, 213-214 Centre street, New York, illustrating his line of projectors and searchlights for use on large steamships, and small yachts, as well as for freight and pleasure boats of every description. The lamps on these projectors may be turned in a continuous circle, and the cylinder is snow and waterproof. He also describes the pilot house projector of his electric focusing arc lamps operating singly or in series on 110, 220, or 500 volt circuits. The lamps are made from 1,000 to 10,00 c. p. An aluminum reflector is provided which obliterates all shadows. These lamps are suited for use by photographers, photo engravers, and lithographers, as well as for electric fountains, blue printing, etc. Mr. Bogue also makes a specialty of rewinding armatures, repairing commutators and doing general installation and construction work.

MR. A. O. SCHOONMAKER has issued a very neat illustrated bulletin in regard to his India and amber mica, and giving three very interesting views of the mines from which he draws his supplies. His headquarters are 158 William street, New York, and 1563 Monadnock Building, Chicago.

Digitized by Google

An Interesting Catalogue on Mica.

It is not often we have such a neat and interesting catalogue to look over as one lately received from the Mica Insulator Company. A short illustrated history of Mica, down from the times of Thales and Mahomet to those of the Anglo-Indian, opens the book. The illustrations in this article give a good idea of the Mica mines of India. There are strange looking ladders crowded with Hindoos passing up mica and water in baskets and jugs, other Hindoos sitting on their haunches, on the open ground, sorting and trimming the transparent crystal; bullock carts loading, and on their way down the mountains, and the mine owners' bungalow.

Micanite is then treated in a very exhaustive manner. It is shown how, by splitting and reassembling the raw laminations of the mica crystals the natural defects are overcome, and a homogeneous material produced. The tables given are useful and instructive. They include "Resistances," "Breakdown Voltages," etc., of a large number of insulators. Other instructive articles have for their titles "Physical Properties of an Insulator," Armature Notes, Construction of Commutators and one relating to "Field Spools."

The business part of the catalogue includes all the specialties made by the company. Among others, micanite plate, flexible micanite plate, micanite cloth and paper, micanite commutator segments, micanite rings, armature troughs, washers, tubes, spools, cylinders, etc., all too well known to receive special mention. A striking feature—one that shows the extent of the electric railway business of the country, is the fact that a list of complete commutator insulators for fifty-one types of street railway motors is given. Space is also given to the other materials manufactured by the company, including "Empire" oiled papers and cloths, linen and asbestos, etc., and similar materials treated with their "M I C compound." We can advise all electrical engineers interested in the improvements made in electrical insulation to send for this catalogue. They will find it both instructive and useful.

Impulse Water Wheel Company.

The new water wheel catalogue issued by the American Impulse Wheel Company, 120 Liberty street, New York, has just been received, and contains a great deal of valuable and interesting information on the subject of water wheels in general and the impulse wheel manufactured by this company in particular. A great deal of time and thought must have been expended on this book, which will prove of great value to any one interested in the subject of water power and long distance transmission. The catalogue contains data for estimating the head and quantity of water power and speed of water wheels, as well as the construction of pipe lines. There is a chapter on weir measurements and tables for weir dams, power of water and speed for standard wheels, and one on the use of turbines, all accompanied by explanatory notes. A large variety of impulse wheels for various purposes are illustrated, as well as the Lombard governor and the McCormack turbines. Annexed to the catalogue is a table giving the average water pressure in various cities taken from Baker's Manual of American Water Works. The catalogue is handsomely bound, and is a credit to this company which of late years has done such useful work in the developing of water powers of this and other countries. The catalogue will be sent to any one on application.

Allgemeine Elektricitäts Gesellschaft.

The above company, which might be said to represent to a very large extent, the electric railway development in Germany and adjoining countries, have recently issued a very interesting pamphlet containing a list of roads equipped by them. Fifty-five roads are enumerated, with a total length of track of 1,095 km.; 1,861 motor cars and 12 snow sweepers. Twenty more roads are in course of construction. The tables give the following data of each road: The year the road was opened, name of the company operating the road, its length, distance between tracks, kinds of tracks used, maximum grade, number of motor cars, trailers, motors, boilers, with their evaporating surface; number of steam engines, their capacity; total capacity of the plant, number of generators, their voltage and the total power in kilowatts. It is a valuable pamphlet and one which gives a splendid idea of the progress of electric railroading abroad.

Smith & Hemenway Company.

A very attractive and useful catalogue has just been issued by the above company, located at 20 Warren street, New York, which contains a mint of information on various kinds of cutlery, such as knives, pliers, razors, etc. A large portion of the catalogue is devoted to a description of the telephone apparatus manufactured by the Ericsson Telephone Company, also located at 20 Warren street. There are shown the desk and interior telephones as well as the long distance transmitter, double pole receiver, Swedish induction coils, and the Ericsson Swedish coal-grain microphone. The catalogue also contains a description of the goods manufactured by the Utica Drop Forge & Tool Company and the Swedish Razor Company.

New York Trade School.

The annual catalogue of the New York Trade School, located on First ave., between 27th and 28th sts., New York, has been received, and contains very interesting details about the splendid work done by the students of this admirable institution during the past few years, and the announcement of the courses for the coming year. These include bricklaying, plastering, plumbing, electrical work, carpentry, house painting, steam fitting, fresco painting, blacksmith work, printing, sign painting, sheet metal cornice work and drawing. Day and night instruction is given for moderate fees which include the use of tools and materials. The system of instruction followed at the school is what is known as the "Auchmuty System, and was originated by the founder. By this system a course is arranged in which both the practical and theoretical branches of the trade are taught, so that not only is the school training quickly acquired, but the scientific principles that underlie the work are also mastered. Mechanics of high skill and long experience act as instructors. Each student receives individual care and attention. The equipment of the respective workshops of the school offers every facility for instructive purposes. Since the New York Trade School was founded, 6,805 young men have attended the school, and during the past five years the annual attendance has averaged over 500 students. The fee for the electrical course is $16 for the entire course, and is reserved for young men between seventeen and twenty-two years of age. The different divisions included in this course are bell work, burglar alarm systems, electric gas lighting, and electrical wiring, and judging from the work of the students illustrated in the catalogue the instruction seems to be thorough and practical. This catalogue will be sent to any one on application to the school.

Denver Engineering Works.

A very handsome pamphlet has recently been issued by the above company, located at Denver, Col., showing a great variety of steam and electric hoisting plants installed by them. Numerous illustrations of direct-acting hoisting engines are shown and their advantages for different classes of work are pointed out. They also show hoists driven by double engines as well as friction hoists, various kinds of mining hoists and a large number of similar machines driven directly by electric motors. The catalogue also contains several interesting and valuable tables, and the book must certainly prove of value to anyone in need of such apparatus. The catalogue will be sent to anyone on application.

The "Zeitschrift für Elektrochemie."

Since July 1 our esteemed contemporary, the Zeitschrift für Elektrochemie, which is edited by Dr. W. Nernst and Prof. W. Borchers, has appeared weekly instead of bi-monthly. This change has been found necessary on account of the number of important articles which it had been found impossible to publish for want of space. The quarterly subscription will, however, remain the same as heretofore.

SCHOENHOFEN BREWING CO., Chicago, has ordered from the Ball Engine Co., Erie, Pa., one 100-horse-power engine, direct connected to Western Electric dynamo.

Digitized by Google

TRADE NOTES AND NOVELTIES

The C & C Agency in Chicago.

Mr. Martin J. Insull, of Chicago, formerly of the engineering firm of Sargent & Lundy, has been a visitor in New York during the last week. While here Mr. Insull arranged with The C & C Electric Co. to represent them in the Chicago territory, with headquarters in rooms No. 1012 to 1013 Monadnock Block. Sargent & Lundy have during the past year represented The C & C Electric Co. in Chicago, with Mr. Insull in charge of the electrical department, but with Mr. Insull's recent withdrawal from the firm the C & C agency was relinquished. Mr. Insull's long experience in the electrical field, his extensive acquaintance, his thorough familiarity with C & C apparatus, and the general excellence of the product of The C & C Electric Co. assure the success of his efforts.

New G. E. Machine Shop at Schenectady.

WORK on the machine shop of the General Electric Company at Schenectady was begun last week, when ground was broken for what will be a most important addition to the great manufacturing facilities of that company. The contracts have been let to A. & R. Roberts, of the Pencoyd Iron Works, Philadelphia, for the steel construction and to J. J. Turner, of Amsterdam, N. Y., for the masonry, etc. The cost of the new building is estimated at $175,000. The new machine shop will face on Central avenue, opposite Building No. 15. It will be 653 feet long and 166 feet wide and will be divided into three aisles; the central one having a width of 65 feet, the side aisles being each about 50 feet wide. The total floor space of the building will be not less than 144,250 square feet. It will contain the machinery necessary to handle the very large apparatus which the requirements of modern practice have rendered necessary.

The need of such an addition to the manufacturing facilities of the General Electric Company is realized after a visit to the factory at Schenectady at the present time. The many orders both for large machinery and for large quantities of apparatus, are severely taxing their facilities, and such has been the rush of work that the traveler on the New York Central Railroad as he passes the town at night sees at least half of the buildings lighted up and filled with employees busily engaged in pushing forward to completion the orders in hand. The running of night shifts has been carried on since the beginning of the year, and according to the superintendent, there are few signs of the practice being abandoned for the present. It is expected that the new machine shop will be completed before the end of this year. The machinery will be driven by the current transmitted from Mechanicville, 17 miles distant.

In addition to the new machine shop, the General Electric Company is making several important extensions to other buildings. The new foundry, which was recently begun, is now in position to receive the iron work, the support for the great traveling crane having been erected last week. This building when finished will contain, it is said, the largest foundry under one roof in the world.

ADVERTISERS' HINTS

CROCKER-WHEELER ELECTRIC COMPANY show an excellent illustration of power generator.

WESTERN ELECTRIC COMPANY advertise a speaking tube as being one of the requirements of every thoroughly equipped electrical supply house.

WESTINGHOUSE ELEC. & MFG. COMPANY show illustrations of their Multipolar Generator and Motor.

C & C ELECTRIC COMPANY are advertising a new type of slow speed motor and dynamo to be known hereafter as "P. P."

VICTOR CIRCUIT BREAKERS are advertised by F. A. La Roche & Co.

THE COLUMBIA INCANDESCENT LAMP COMPANY refer to trial orders for their well known make of lamp, and keep continually a large stock on hand in order that prompt shipments may be made.

J. JONES & SON call attention to their automatic time cut-out which will pay for itself in a short period by the mere economy effected by a sale.

ELECTRIC APPLIANCE COMPANY announce a flexible conduit for interior wiring.

THE GARVIN MACHINE COMPANY show an illustration of a universal milling machine, and announce that they have over a thousand machine tools, both new and second-hand, that are ready for immediate delivery.

WESTERN TELEPHONE CONSTRUCTION CO., Chicago, has considerable to say in regard to the Carty patent.

WESTERN NOTES

ELECTRICAL APPLIANCE CO., Chicago, says: "While iron and steel armored conduit is being used to the exclusion of almost everything else in new conduit work, there is nevertheless a great deal of work where iron armored conduit cannot be used. The most satisfactory substitute under such circumstances is Canvasite flexible conduit. This is particularly useful in wiring or rewiring old buildings and in difficult and out of the way places in new buildings. The Electrical Appliance Company are carrying Canvasite flexible conduit in all sizes from ¼ inch to 1¼ inch and find that it has a ready sale for the above mentioned uses."

THE NEW YORK & OHIO CO., manufacturers of the celebrated Packard transformer, have recently brought out their latest model, which is to be known as "Model 98." The results secured on this new model are noteworthy in the way of transformer regulation and efficiency. The Electric Appliance Company, general Western agents for the Packard transformer are distributing special circulars of the same, giving tabulated results of a number of tests. The manufacturers of this transformer are prepared to guarantee these results on each and every transformer sold, and a large fall trade is looked for on the "Model 98."

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, has recently analyzed fourteen boiler feed waters and shipped two carloads of suitable scale solvents to large sugar concerns in the Hawaiian Islands.

THE ELECTRIC APPLIANCE CO. have recently issued a little folder calling attention to their "Self-Contained Automatic Telephone Hook." This hook was designed by the manager of their telephone department and is manufactured exclusively by the Electric Appliance Company. It is claimed that it can be installed in a smaller space than any other hook on the market. Its installation is very easy, as the hook is put together complete in one piece of apparatus; and all that is necessary is to screw it in the telephone box.

GREENMAN ELECTRIC CO., of Sioux Falls, Iowa, is in the market for good electrical agencies in its territory. It has a paid-up capital of $2,000, and is making and selling electrical supplies, steam and gasoline engines, mechanical supplies, etc. H. K. Greenman is president and manager; M. E. Greenman, vice-president, and E. P. Greenman, secretary and treasurer.

NEW ENGLAND NOTES

THOMAS WESTCOTT is the name of a man against whom the police give warning. One of his recent swindling tricks was to use stationery like that of the Columbia Electrical Co. of Worcester, Mass., with a false statement of change of address, and then order all kinds of goods sent to the "new" address in Boston. One New Jersey firm sent on goods, which Westcott at once turned over to a junk dealer for $900.

NEW HAVEN, CONN. The New Haven Gas Light Company have placed the contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for their new fireproof coal shed. The building is 60 feet wide and 500 feet long. The framework of the building is steel, so arranged that the coal cars are brought into the building on a track supported by the roof trusses, the idea being to provide the maximum storage at the least expenditure of power and room.

Digitized by Google

A Novel Job at Adrian, Mich.

Clarence Belcher, an 11-year-old lad of Rome Center, has a unique job with the electric lighting company, says the Adrian "Times." He comes here once a year and works about two days and a half in the capacity of "oiler" of the street lamps. The lamp is lowered to the ground, Clarence gets astride the iron shade, and is then drawn up to the wire, where he oils the pulleys. The little fellow has all kinds of nerve and secured his present positon last year through his reputation as a climber. He gets 50 cents a day.

Telephony from Paris to Berlin.

A long distance telephone service is being arranged to connect Paris and Berlin. Messages will be received at Brussels and thence transmitted to the two termini. It will be interesting to see what kind of treason will be sent across by wire from Berlin to Paris when this new service is got into operation. At any rate, it will be a capital thing for Brussels, as this city will thus become the centre of telephonic communications in the middle of Europe.

Electricity for the Central Pacific.

Electric locomotives for operating the mountain divisions of the Central Pacific Railway are said to be under consideration. It is believed that sufficient water power can be obtained from the mountain streams in the vicinity of the line to generate the current, and it is proposed to operate the road in this way from Sacramento east across the Sierra Nevadas to Verdi, Nev., a distance of 144 miles. While the above is only newspaper rumor, the high price of coal on the Central Pacific makes the story one which is not at all improbable.

NEW YORK NOTES.

MR. A. D. ISHAM, New York branch, 107 Liberty street, of the Eureka Tempered Copper Works, has been amusing his summer leisure by sending blotters to his friends. He says a prosperous season is at hand.

MR. G. A. NISBET, general manager of the Electric Appliance Co., Thomas Building, New York, has placed his Chicago agency in the hands of Mr. Martin J. Insull, who has recently opened up in that city as a manufacturers' agent. This agency includes the States of Illinois, Wisconsin, Michigan and Indiana.

STUCKY & HECK ELEC. MFG. CO., New Jersey Railroad avenue, Newark, N. J., are running their factory overtime and have been doing so for some weeks past, on all kinds of repair work.

EDMOND ELEC. TRACTION AND SIGNAL CO. has been formed with a subscribed capital of $500 by D. N. Maxon, G. E. Cruse, C. S. Jones, D. A. Davies and R. H. Starr, all of New York City.

MANHATTAN RAILWAY CO. says it is still expecting to make the change to electricity, and that the matter will be put through as soon as possible after Mr. Gould's return this month, when, it is alleged a preliminary contract with the General Electric Co. will be put in execution.

PHILADELPHIA NOTES

THE ST. AGNES HOSPITAL, Philadelphia, will have an electric plant. The engines, which are to be built by the Ball Engine Co., Erie, Pa., are direct-connected to Eddy dynamos.

HUBBELL ELECTRIC LAMP CO., 1311 Capouse avenue, Scranton, Pa., are putting on the market a new electric lamp, chiefly for bicycle riders. The officers of the company are: Capt. C. J. Hubbell, president; Dr. L. M. Gates, vice-president; W. D. Boyer, secretary and treasurer. The company is reported as very busy.

HOT WEATHER has driven a good portion of the foreign population of Philadelphia into the rural suburbs, reached by trolley, where they spend the night in the woods in order to get sleep. Fox Chase is a favorite resort on account of its freedom from mosquitoes.

MR. T. B. DOOLITTLE has been awarded the Edward Longstreth medal of the Franklin Institute for his work in developing and securing the use of hand-drawn copper wire, of which such large use is now made, especially in telephony.

SOUTHERN NOTES

CENTRAL MANUFACTURING COMPANY, of Chattanooga, Tenn., are issuing a large postal card on which they enumerate a number of their excellent specialties in the electrical woodworking line, such as cross arms, pins, brackets, etc., with weights and prices in each case. They will be glad to receive inquiries as to line construction material.

CAROLINE LIGHT & POWER CO., Aiken, S. C., has recently ordered a 250 h. p. cross-compound engine from the Ball Engine Co., Erie, Pa. The engine is supplementary to their present power plant.

COLUMBUS, GA. The Columbus Power Co. is to develop electrically a water power of 40,000 h. p. President H. M. Comer, of the Central Railroad of Georgia, is at the head of the enterprise.

CONTENTS.

EDITORIALS:
Moribund Manhattan 178
When Jackie Comes Sailing Home 179
Scaling Down and Scaling Up 179

POWER TRANSMISSION:
The Snoqualmie-Seattle-Tacoma Transmission with Aluminum Live Wire (illustr.) 169
The Enlargement of the Niagara Power House (illustr.) ..... O. E. Dunlap. 170

TELEPHONY AND TELEGRAPHY:
Individual Motors for Coil Winding in a Telephone Factory 170
Timing Calls in Telephone Exchanges (illustr.) ..... Henry Abbott. 171
A Great Advance in Fire Alarm Telegraph Protection ..... J. W. Aydon. 176
Congress Fixes Washington Telephone Rates.—Telephones in Cape Colony.—Independent Telephony in Michigan.—Independent Toll Line Telephony in Iowa 177

MISCELLANEOUS:
Tesla Circuit Controllers for Obtaining Oscillatory Currents of High Frequency (illustr.) 180

ELECTRIC TRANSPORTATION:
The McGurty High Speed Electric System for Mail and Express Service (illustr.) 183
Power Consumption in Electric Railroading—II ..... S. T. Dodd. 184

NEWS AND NOTES:
The Modern Round House Turn-Table: The Westinghouse Electric "Donkey" (illustr.) 185

ELECTRIC LIGHTING:
Fourth Annual Meeting of the Ohio Electric Light Association.—The New Welsbach Incandescent Lamp Filament 186
The Economical Carboning of Arc Lamps ..... W. J. Clarke. 187

SOCIETY AND CLUB NOTES:
Sixth Annual Meeting of the Society for the Promotion of Engineering Education 187

EDUCATIONAL:
Electrical Course at Pratt Institute 187

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Aug. 9, 1898 188

LEGAL NOTES:
An Accident from Stealing Trolley Rides.—Damages for Passengers on Electric Car Frightened by Flashes 188
Purchase of Municipal Lighting Plant.—Responsibility for Flywheel Accident 189

THE STOCK MARKET:
Confidence 189

REPORTS OF COMPANIES:
General Electric Stock Scaled DownTwenty Millions.—Electric Storage Battery Co. 189

CATALOGUES:
Charles J. Bogue's Marine Projectors and Searchlights.—Mr. A. O. Schoonmaker 189
An Interesting Catalogue on Mica.—Impulse Water Wheel Co.—Allgemeine Elektricitäts Gesellschaft.—Smith & Heminway Co.—New York Trade School.—Denver Engineering Works 190

TRADE NOTES AND NOVELTIES:
The C & C Agency in Chicago.—New G. E. Machine Shop at Schenectady.—Advertisers' Hints.—Western Notes.—New England Notes 191
A Novel Job at Adrian, Mich.—Telephony from Paris to Berlin.—Electricity for the Central Pacific.—New York Notes.—Philadelphia Notes.—Southern Notes 192

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. SEPTEMBER 1, 1898. No. 539.

The Mechanicville, N. Y., Three-Phase Transmission Plant.

INTRODUCTION.

THE development of the power of St. Anthony's Falls, on the Mississippi, at Minneapolis, Minn.,[1] is followed closely by the utilization of the power of the upper waters of the Hudson River at Mechanicville, N. Y., where an undertaking of no less magnitude has, within the past few days, been completed. Five to seven thousand horse power is available at the power house and the use of high tension current permits of its distribution over a wide territory.

Early in 1897 the attention of Mr. R. N. King, president of the Stillwell-Bierce & Smith-Vaile Company, of Dayton, O., was drawn to this water power. His long experience with water powers and their development led him speedily to recognize the possibilities which here lay ready to hand. The site is only two miles from Mechanicville, eleven miles from Troy and eighteen miles from Albany, in each of which towns large quantities of power would without doubt find a market. But most important of all, it lay only seventeen miles from Schenectady, where, covering not less than 130 acres of ground, the largest electrical works in the world are operated from an extensive steam plant, with which the electrical power from the Mechanicville cataract could readily compete.

After consultation with the chief engineers of the General Electric Company, in which the necessary assurances were given, Mr. King formed the Hudson River Power Transmission Company. The hydraulic engineering features of the development were carried out in their entirety by Mr. A. C. Rice, chief engineer of the Stillwell-Bierce & Smith-Vaile Company, and it may be said that in the complete work as it stands today little or no departure from the plans laid down by Mr. Rice has been made. As the General Electric Company was to purchase the largest amount of power, its advice as to the electrical equipment was naturally closely followed. The result brought about by the harmonious co-operation of both hydraulic and electrical engineers is a power transmission plant in every respect strictly representative of the most modern hydraulic and electrical practice.

THE POWER BEFORE DEVELOPMENT, MECHANICVILLE, N. Y.

GENERAL LOCATION.

At the point chosen for the hydraulic development the physical conditions make the location an ideal place for a dam and power house. The banks and bottom of the river are of rock, as is Bluff Island, which divides the Hudson into two channels, and here during the greater part of the year is water sufficient to produce from 7,000 to 10,000 h. p. The island is about one-third of the distance across the river from the western bank, ,the combined width of the two channels being about 1,200 feet. The

THE MAIN DAM AND WASTE GATES, MECHANICVILLE, N. Y.

[1]Electrical Engineer, June 2, 1897, and May 5, 1898.

Digitized by Google

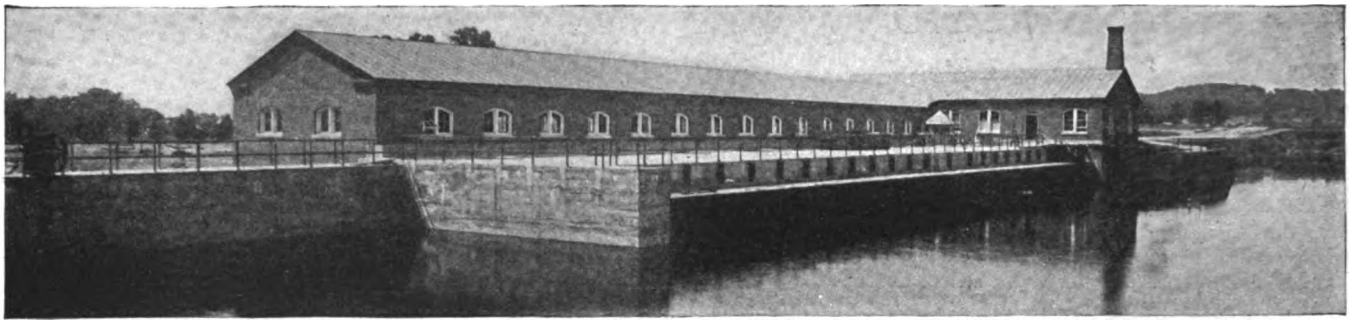
western channel is used for the head and tail races. In order to make the excavations for the power house and the main dams heavy cofferdams were built across both streams.

DAMS.

The power house starts from and extends out into the river about 215 feet, and is connected with Bluff Island by a concrete dam 26 feet high above the bed of the river, 10 feet wide on top and 18 feet wide at the base. The up-stream face is vertical and the down stream face sloping. The top of this dam is at an elevation that the water will never reach; thus, no provision is made to take care of falling water on the down-stream side, but the dam is provided with four arched waste-gates 4 feet wide and 6 feet 9 inches high, operated in the same manner as those in the main dam.

The main dam is on the eastern side of the island. It is built entirely of concrete, as indeed is the entire construction, with the exception of the upper walls of the power house. The up-stream face is vertical, the down-stream face is curved and provided with a horizontal apron 14 feet wide, which throws the falling water off horizontally, and thus effectually prevents wash or scour of the toe of the dam. The dam is 16 feet high above the river bed, 8 feet thick immediately below the crest, 16 feet thick through the base and 30 feet thick through base and apron. The dam is set between massive abutments anchored to the rock sides of the river bank and island. The length of the spillway between abutments is 800 feet.

In the western abutment are twelve arched waste-gates of ample proportions. Each gate is 4 feet wide and 6 feet high, and is opened and closed by a heavy iron hoist operated by rack and pinion. The eastern dam is practically a solid rock wall capable of safely resisting any flood. To prevent any floating rubbish, ice or logs reaching the rocks or choking the waste-gates, a floating wooden boom stretches from the western end of the spillway diagonally for a distance of 400 feet to the edge of the normal river bank, and then for a distance of 1,000 feet to the main embankment of the Mechanicville highway. It is anchored to a line of stone-filled cribs. Between the west end of the power house and the Mechanicville highway a broad roadway has been built of earth and slate rock.

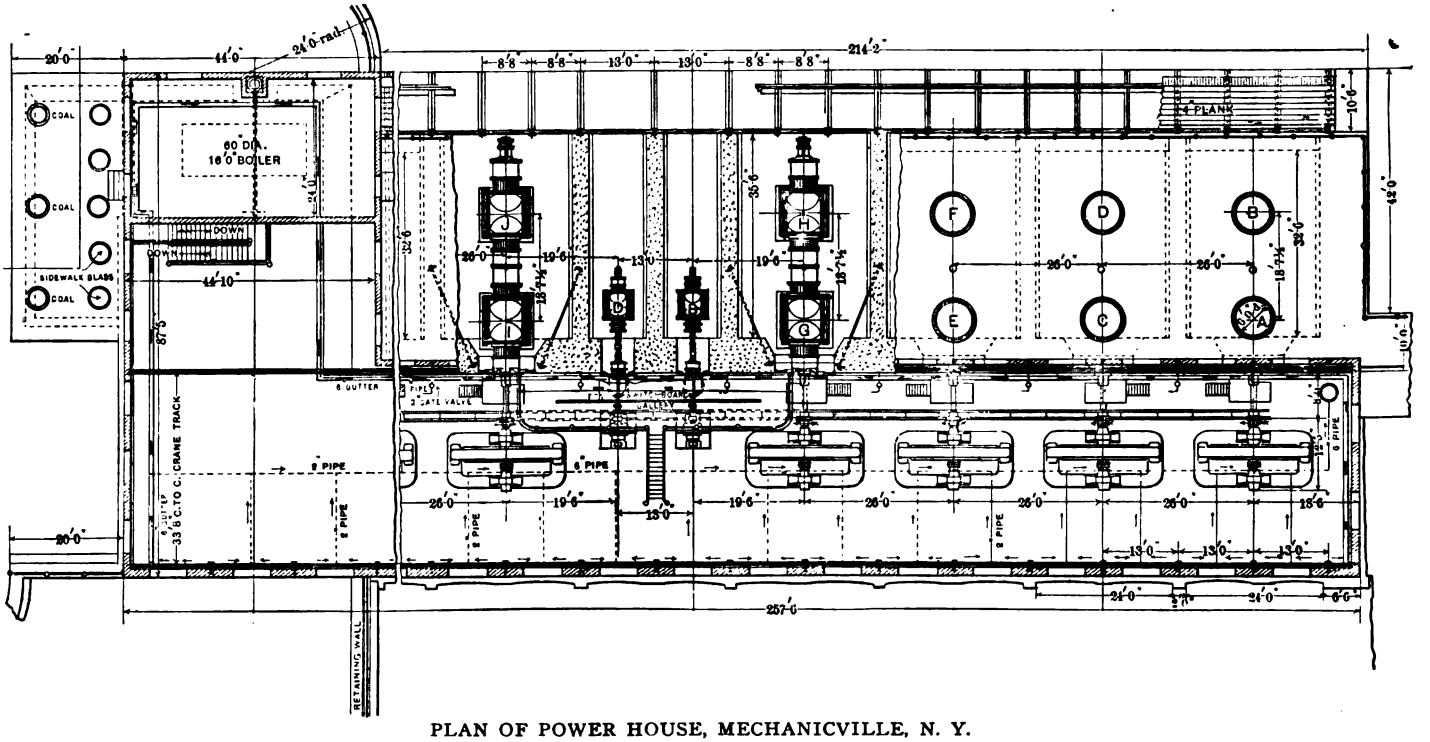


UP-STREAM SIDE OF POWER HOUSE, WITH FOREBAY, MECHANICVILLE, N. Y.

To avoid any possibility of water finding its way through the embankment in case of very high water, a concrete core was put in the centre, starting at the solid rock and finishing two feet below the surface of the road. The embankment forming the roadway is 40 feet wide on the top, 124 feet at the base and 18 feet high at the deepest point.

THE POWER HOUSE.

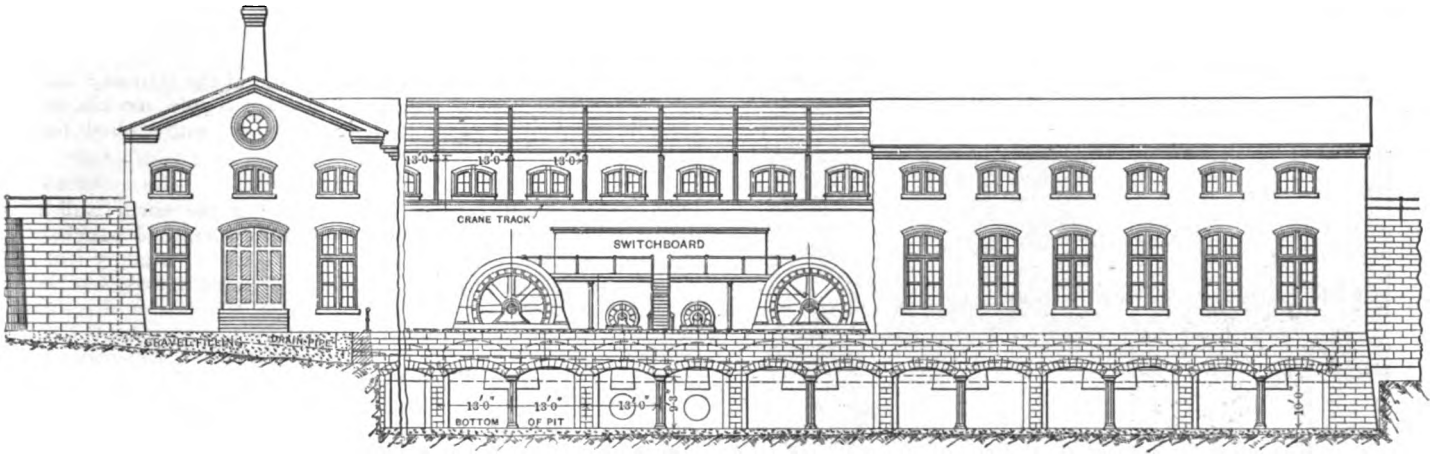
The power house lies between the west bank and the short concrete dam, nearly filling the space between the island and the west bank of the river. It is practically a continuation of the dam, and, like the main dam, is of concrete, with the exception of the upper walls. Its construction is of the most substantial character, the foundations are carried down to the bedrock and the house is carried on heavy steel box web girders resting upon steel I-beam columns. The latter are imbedded in concrete walls carrying arches, which form the floor of the generator room and the floor on which the wheel flumes rest. The walls form a separate and distinct tail race 22 feet wide for each set of turbines, from which the water may be shut out at will.



PLAN OF POWER HOUSE, MECHANICVILLE, N. Y.

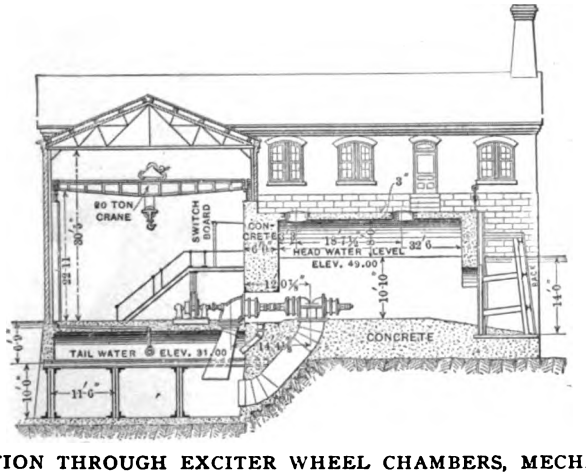
Digitized by Google

The house is divided into two parts by a thick head wall. The up-stream part contains wheel chambers for seven 1,000 h. p. wheels, of which five only are at present occupied. The down-stream portion contains the wheel governors and the electrical apparatus. The length of the power house proper is 257 feet 6 inches, the width of the dynamo room between head wall and south wall, 34 feet, and the width of the wheel chamber portion 32 feet 6 inches. The total width of the power house is 66 feet 6 inches. At the western end an "L" extension runs up stream 87 feet 5 inches long and 44 feet 10 inches wide. This portion of the power house is of brick. A retaining wall runs down stream from the power house along the western bank a distance of 50 feet. The western stream, running between the bank and the island, forms the forebay, 300 feet long. The main tail race is 205 feet wide and joins the main stream 750 feet below the power house.



SIDE ELEVATION OF POWER HOUSE, MECHANICVILLE, N. Y., LOOKING UP-STREAM.

Arched chambers are provided for seven main wheels and two exciter wheels. Each main chamber is 32 feet 6 inches long, 22 feet wide and 17 feet 5 inches high, and is provided with two 6-foot manholes. Each exciter wheel chamber is 32 feet 6 inches long, 17 feet 5 inches high and 10 feet wide. The head wall of the chambers is 6 feet thick, the wall on the up-stream sides 3 feet thick. In the head wall of each main chamber is set a heavy cast-iron cover, through which the turbine shaft passes in a watertight packing box, carrying the ring oil bearing for the shaft. The saving in space effected by the new arrangement of housing and coupling together of the turbines, patented by the Stillwell-Bierce & Smith-Vaile Company, has tended to diminish considerably the size of the power house. A 20-ton crane from the works of Pawling & Harnischfeger, Milwaukee, runs the entire length of the dynamo room.



SECTION THROUGH EXCITER WHEEL CHAMBERS, MECHANICVILLE, N. Y.

In front of the wheel chambers and running the entire length of the power house is a trash rack of steel bars supported on a framework of steel channel and I-beams. This rack effectually prevents the access to the wheels of any rubbish or floating material that may escape the boom.

MAIN WHEELS.

The main wheel plant consists of ten pair of 42-inch horizontal Victor turbines of the latest type, built by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, O. Each main turbine consists of two pair of wheels, which, at the normal speed of 114 revolutions, is rated at 250 h. p. The total power of each set of turbines is, therefore, 1,000 h. p. Five units are now in position; the two additional turbines will be installed shortly. The head under which the water wheels are operated is 18 feet.

EXCITER WHEELS.

The turbines for the exciters consist of three 18-inch Victor cylinder gate wheels, having, at 259 revolutions per minute, a total of 300 h. p. The quarter turns and packing boxes of these wheels are brought through the wall beneath the station switchboard.

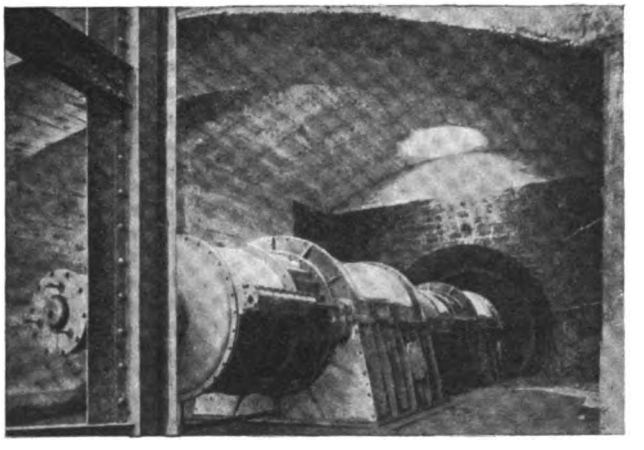
DRAFT TUBES.

Two draft tubes lead from each main turbine, the forward tube descending straight into the tail race beneath the power house, the rear or up-stream tube curving and flaring downward and outward. Each tube is 9 feet 6 inches in diameter at the bottom. Two draft tubes are also allotted to each set of exciter wheels, the setting following a similar arrangement. The rear tube is 4 feet in diameter, the forward tube, 3 feet.

MAIN AND EXCITER WHEEL GOVERNORS.

The speed of each set of main wheels is regulated by a Geisler electro-mechanical governor, mounted on a platform directly over the turbine shaft and between the head wall and the generator.

The use of electricity renders the mechanism of this governor extremely sensitive and effective, and the gates can be entirely opened or shut, should the full current be thrown on or off, in six seconds. The driving pulley is replaced by a rawhide pin-

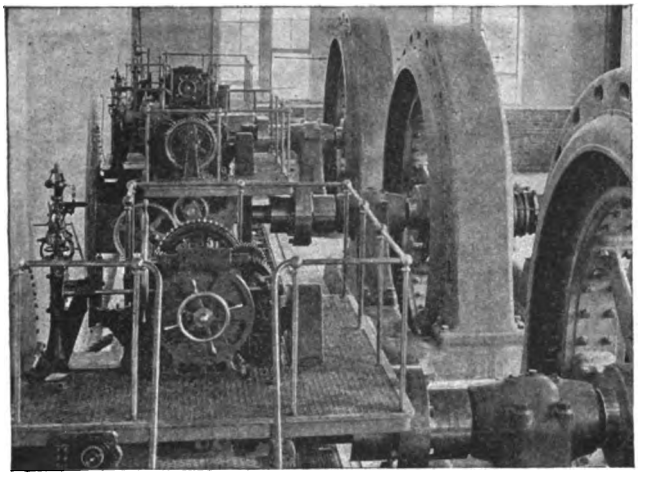


A MAIN WHEEL CHAMBER, MECHANICVILLE, N. Y.

Digitized by Google

ion, giving a rigid connection between the governor and the wheel, and making 400 revolutions per minute. The speed may be increased to shut off or throw on in less than six seconds if necessary. The Geisler governor is now in use in many of the most important electric power transmissions in this country and Canada, including those of Columbia, S. C.; Pelzer, N. C.; Lachine, Que.; West Kootenay, B. C., and Montmorency, Que.

The governors controlling the exciter wheel gates are improved "Snow" governors, which rapidly bring the speed to normal when changes are neither frequent nor heavy. They are especially adapted to the regulation of water wheels driving exciters, and are provided with adjustable stops, which limit the hoisting action on the gate as soon as the gate is fully open.



MAIN WHEEL GOVERNORS, GEISLER TYPE, MECHANICVILLE, N. Y.

GENERATORS.

The dynamo room is a spacious chamber, well lighted by windows on all sides. It is 255 feet long and 34 feet wide, 30 feet 5 inches in the clear from floor to roof truss and 22 feet from floor to crane. The ultimate generator capacity of the station is 7,000 h. p. in seven generators, each of 750 kilowatts capacity. Five have been installed and are now running. They are unitooth, three phase, 40-pole 114-revolution alternating current machines, having revolving fields and stationary armatures, and wound to deliver 36 amperes of current at a periodicity of 38 cycles and a pressure of 12,000 volts to the transmission lines. They are arranged for operation in parallel at constant voltage. By using the revolving field type of generator and thus securing this pressure directly from the machine, the use of step-up transformers to raise the voltage for transmission purposes is avoided. As the current is to operate synchronous and induction motors, to operate lights and to be converted into direct current through rotary converters, a frequency of about 40 cycles was selected as most suitable for the different conditions required.

The alternators are similar in their main characteristics to those successfully used in the development of the power of the Lachine Rapids at Montreal.

The armature frame or ring is of the box type, 15 feet 4 inches in diameter and 36 inches wide. It is bolted to a base 18 feet 2 inches long by 10 feet wide, along which it may be moved parallel with the shaft, in order that the revolving field spider and poles may be uncovered should occasion arise. The armature winding is protected on each side by iron shields. The pillow blocks are also bolted to the base, and the bearings are of the spherical seated self-oiling type used in all General Electric generators.

The field ring is bolted to the spokes of the spider. It carries 40 poles, each securely fastened by two bolts to the ring. The whole revolves on a shaft 15 inches in diameter, provided with a rigid coupling on the turbine side bolted to a similar coupling on the turbine shaft. The dynamo shaft is extended for coupling to a vertical steam engine in case of necessity.

The following reasons for securing this type of alternator have been given by Mr. C. P. Steinmetz, of the General Electric Company: In addition to the advantage which the stationary armature type has over the stationary field type in allowing a high transmission voltage to be taken directly from the armatures, it allows of a fairly low saturation of the magnetic circuit, giving an almost straight saturation curve. This is preferable in power transmission, since a considerable increase in the voltage may be obtained, if needed, to cover excessive drop in the lines due to heavy loads, and the voltage may be maintained even if the speed remains low.

EXCITERS.

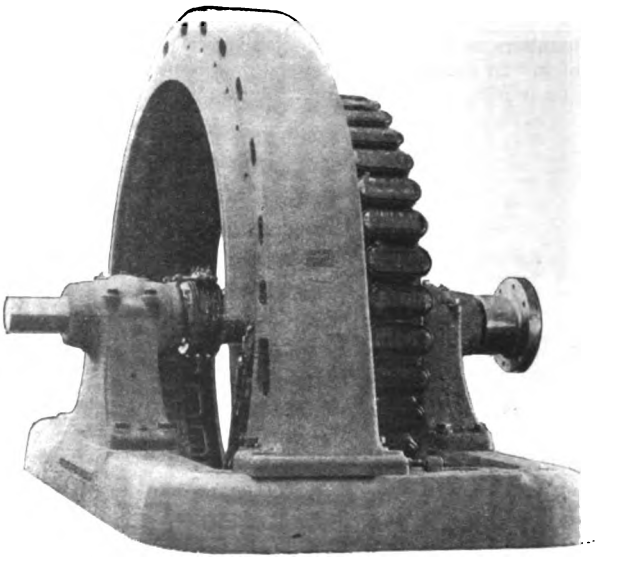
The exciters are placed one on each side of the stairway leading to the switchboard gallery. They are 6-pole 100-kilowatt 125-volt standard General Electric machines, with ribbed field frame and ironclad armatures.

SWITCHBOARD.

The switchboard, erected on a gallery on the north wall of the dynamo room, is built up of nine highly polished panels of blue Vermont marble, each panel 7 feet 6 inches high, 3 feet 0 inches wide and 2 inches thick. Of these nine panels, five are used for the generators and two for the feeders; one is the total output panel and the last is for the control of the exciters. The generator panels occupy the left side of the board, and room on the gallery is left for two additional panels. The feeder panels are on the right side; the total output panel is between these and the generator panels, and the exciter panel is the third panel from the left-hand end of the board.

Each generator panel is equipped with the following instruments. One inclined coil alternating ammeter reading to 75 amperes for the generator and one direct current ammeter reading to 150 amperes for the field. Above each of these is a pilot lamp and between each pilot lamp a synchronizing lamp. Beneath the two ammeters is an inclined coil voltmeter reading to 15,000 volts, and beneath this instrument are three single-blade double-throw quick-break high tension switches, each mounted upon pyramids of corrugated hard rubber. Similar pyramids intervene at the back of the board, between the bus bars and the board. The corrugations give a total distance of about 8 inches of surface between the metal clips and hinge and the surface of the marble on each side.

As these switches are to break current of 12,000 volts, they are tested to break without difficulty currents of 21,000 volts. The switches are without handles. An eye is made in the end of each blade, into which a hook at the end of a stick may be inserted and the switch opened by the attendant from a safe distance. Further, to prevent any dangerous arcing from blade to blade marble barriers 1¼ inches thick, 3 inches long and 12 inches wide from the face of the board are erected between each blade.



750 K. W. G. E. THREE-PHASE ALTERNATOR, REVOLVING FIELD UNCOVERED, MECHANICVILLE, N. Y., TRANSMISSION.

On the left-hand side of each generator panel sub-base are two 100-ampere double-pole double-throw carbon-break switches, one the field switch, the other the lighting switch. On the back of the panels are the high tension fuse blocks.

Digitized by Google

These fuse blocks, designed for 20,000 volts, are of the snap-break expulsion type. They are mounted on pyramids of corrugated hard rubber, which contain copper spring contact clips, between which two copper blades enter, connecting the fuse block to the line. The aluminum fuse is held tightly between two arms, which are moveable around a pivot, and may be pulled apart by two strong spiral springs encircling this pivot. As soon as an increase of current in the line melts the fuse its two halves are instantly pulled apart, and thus the formation of an arc between the two halves is prevented. The melting of the fuse can only occur in a small chamber protected by wooden blocks. The whole device is covered by two vertical wooden boards. Sliding in between these wooden boards in vertical slots are fibre shields intended to prevent arcing over between the two arms after the separation of the two halves of the melted fuse. The two wooden blocks and fibre shields are held in position by four screws. The whole fuse block is inserted in the line simply by pushing the two blade-like copper contacts between the clip contacts, which are connected by solid copper rods to the bus bars. The wooden boards protecting the fuse are 10½ inches long and 6⅜ inches wide. The corrugated rubber pyramids on which the contacts are mounted are 3½ inches high. The field rheostats are hung beneath the gallery and are operated by hand wheels on the gallery and bevel gears below it.

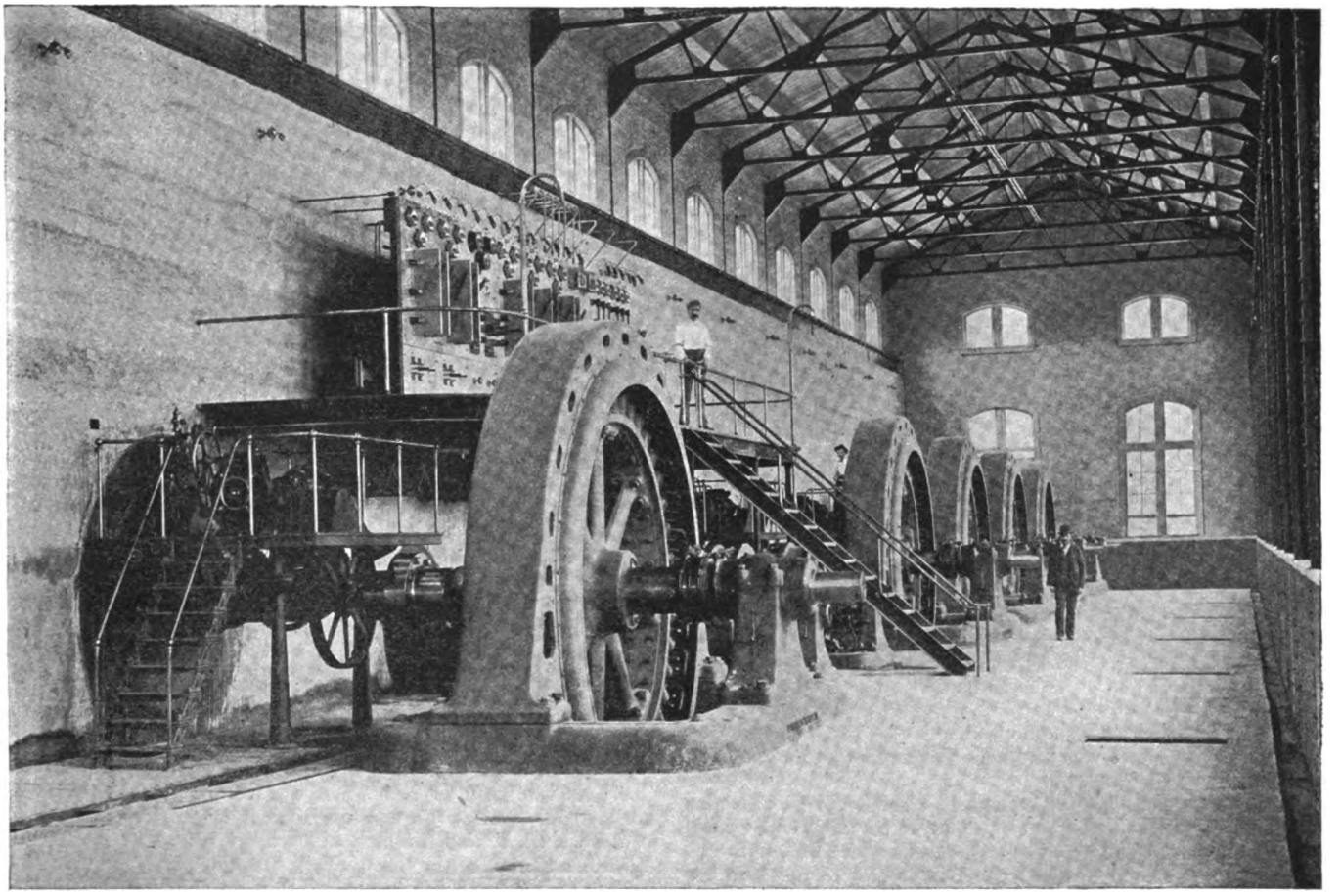
The exciter panel controlling the two direct current exciters carries two pilot lamps, two circular dial ammeters, each reading to 1,000 amperes, one volt meter reading to 150 volts, one four-point pressure switch, one synchronizing switch, two 800 ampere triple-blade double-throw equalization switches and two packed card rheostats.

The two feeder panels are similar to each other in every respect. Each outgoing line is provided with an independent ammeter reading to 150 amperes and a quick-break double-throw high-tension switch, similar to those on the generator panels, and similarly mounted on the board. Mounted also on corrugated hard rubber pyramids are the six circuit-breakers or automatic plunger switches.

These high potential plunger switches consist simply of long copper rods, sliding in hard rubber tubes. The upper ends of the rods reach into small rings, in contact with which they are held by a lever catching a small rubber band on the lower end of the copper rod. This lever is held in place by a spring and is released by moving a rocker arm on the back of the switchboard. The moment it is released a spiral spring pushes the copper rod downward, and by this movement, aided by the action of gravity, so suddenly is the contact broken that arcing between the rod and the ring is prevented. The rocker arm controls the three switches for each set of bus bars, so that they may be all released at once.

On the upper part of each feeder panel at the back is a current transformer for each outgoing line, two recording single-phase wattmeters, each reading to 25 amperes and 12,000 volts, and two potential transformers.

On the front of the output panel are two Thomson recording wattmeters for balanced three-phase circuits, each reading to 300 amperes and 12,000 volts, and twelve triple-pole single-throw 100-ampere switches, with fuses for the lighting circuits. On the back are four potential and two current transformers.



INTERIOR OF POWER HOUSE AT MECHANICVILLE, N. Y.—DYNAMO ROOM.

The lightning arresters are of the G. E. short-gap type. The principle on which this arrester operates is very simple. It allows the passage of any high potential discharge, but effectually prevents the alternating current from following and maintaining an arc. The gap spaces in the lightning arresters at Mechanicville are very small—about 1-32 inch—each space lying between two solid metal cylinders 2 inches in diameter and 2 inches long. A low non-conductive graphite resistance is placed in the circuit, and the action of the arrester, therefore, is dependent upon the cooling effect of the large metal cylinders, aided by the reversal of the alternating current and the introduction of the non-inductive resistance. The line is protected by double-pole 2,000-volt arresters, connected six in series to give the necessary number of spark gaps. There are three sets of these. One at Mechanicville, grouped around the first transmission pole in a small house 15 feet square, one set on the Schenectady side of the

Digitized by Google

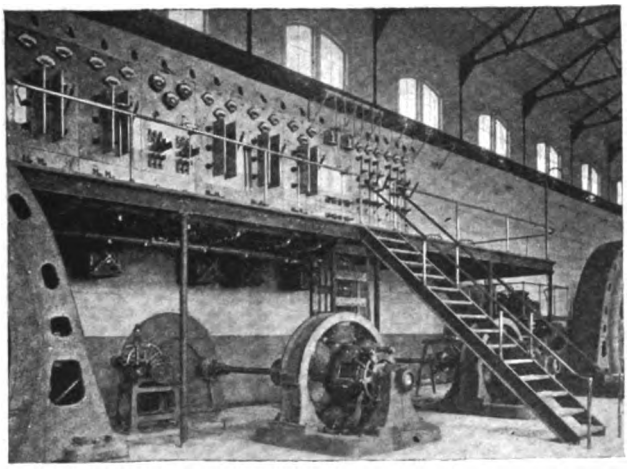
Glenville bridge, where the overhead pole line connects with the underground cable, and the third at the G. E. works.

LEADS.

The lead-covered leads from the generators are taken out at the base of the machine and are laid in ducts in the floor. Rubber-covered wire is used for the field connections. The cables rise on a frame from the duct to the floor of the gallery, through which they rise to the board. From the back of the board the line wires rise to supports bolted to the I-beam on the north wall, which supports one of the grand runways. The lines run along the north and west walls and pass out to the poles through a blind window over the door of the power house.

TRANSMISSION LINE TO SCHENECTADY.

The line from Mechanicville to Schenectady is the only one at present erected. It consists of three No. 000 B. & S. bare wires, this large gauge being employed in order to give the line as high self-induction as possible. This insertion of self-induction in transmission lines is a departure from earlier practice. In cases where synchronizing apparatus is used self-induction is now considered necessary and is artificially brought into the line in the shape of reactive coils in cases in which the natural self-induction is too small. The circuits are carried on poles 30 to 60 feet long and all 8 inches in diameter at the top. Each pole carries one cross-arm, on one side of which are two porcelain insulators of the triple petticoat type, a third being on the other side. For



EXCITERS AND SWITCHBOARD, MECHANICVILLE, N. Y.

lightning protection a barbed wire frequently grounded runs along the top of the pole line.

The line takes a westerly direction to East Glenville and then due south to Schenectady. At the end of the Glenville bridge over the Mohawk, the town limits, it is carried down to the ground and connected to three cables of No. 1 gauge stranded copper insulated by ¼ inch rubber and 3-32 lead sheet, laid in terra cotta conduits. These cables run seventeen hundred feet along Washington avenue, rise to poles again through Rotterdam street to the Erie Canal, and along the canal to a point directly opposite the General Electric Company's power station. They then cross the canal and enter the works.

THE UTILIZATION OF THE CURRENT AT THE GENERAL ELECTRIC COMPANY'S WORKS.

The introduction of this transmitted electrical power into the factory will work a considerable change. At present all the machinery is driven by electric motors, while the testing department demands an independent supply of current for the work it carries on. There are at present, therefore, two distinct generating plants. The 550-volt motors in the testing department are supplied from an engine-driven multipolar generator of 500 kilowatts capacity, while a smaller engine drives a number of exciters, which allow of independent control of the excitation of all machines in this department. The factory is operated by a number of 250-volt motors, running on the same circuit as the factory lights. These motors will not be changed, and the steam plant which supplies them will be retained as a reserve in case the power from Mechanicville should fail. The electric power plant superseding the present steam plant at the works will, therefore, consist of two synchronous motors, one of 500 kilowatts, the other of 100-kilowatts, and three 400-kilowatt rotary converters—the synchronous motors for the testing department, and the converters to supply current to the factory motors.

The large engine driving the 500-kilowatt multipolar generator is superseded by the 500-kilowatt synchronous motor. This is a 12-pole 400-revolution machine of the revolving field type, wound directly for 10,000 volts. The small engine driving the exciters is replaced by the 100-kilowatt synchronous motor—an 8-pole 600 r. p. m. revolving field machine similarly wound. This disposition renders this department independent of everything, the speed of the Mechanicville generators being kept as nearly as possible constant.

The three rotaries supplying 250-volt current to the factory motors are 10-pole 400-kilowatt 480 r. p. m. machines, having two commutators and two sets of collector rings, connected to independent windings on the armature. They receive the three-phase current from independent secondary coils of the same set of air-blast transformers. When connected in multiple they furnish current at normal pressure of 250 volts, but as they may be called upon to furnish current to the testing department in case the demand exceeds the supply from the synchronous motor-driven machine, they may be connected in series to give 500-volt current, operating in parallel with the railway generator driven by the synchronous motors in the testing department.

The rotaries are operated in parallel, and all the factory motors, the factory railway and all the factory lighting are operated from the same direct current circuit, the latter on the Edison three-wire system, the neutral wire of the three-wire system being secured by connecting the transformers for the rotaries in Y with their secondaries and bringing to the neutral a lead from their common connection.

Synchronous motors were selected in preference to induction motors on account, first, of their more constant speed and greater efficiency; second, because they do not produce lagging currents, but the phase displacement and power factor may be controlled as desired by means of control of the field excitation.

Synchronous motors of the revolving field type and of good design are self-starting even under heavy load, and will easily carry two or three times full load without falling out of step for a time, limited only by the heating of the motor.

To make the entire system at the G. E. works self-regulating in the direct current distribution and as far as possible independent of hand regulation, the rotary converters are given shunt field and powerful series field, so joined together that the machines operate as one unit. With constant voltage in the generating station at no load, the counter e. m. f. of the rotaries, as given by their shunt field is below the impressed e. m. f., and a lagging current is produced. The self-induction of the lines is thus in opposition to the voltage, which is so reduced as to give 250 volts at the commutator brushes of the rotaries. As the load increases the counter e. m. f. of the rotaries rises, due to the series field, until at full and overload it is greater than the impressed e. m. f., and the current becomes leading. The e. m. f. of self-induction of the lines is then brought partly in phase with the voltage, which is increased so that, in spite of the increased line current and consequently increased energy loss in the line, with constant generator voltage, the same voltage is produced at the commutator brushes of the rotaries at no load as at full and overload. This control is, therefore, automatic in every way, and did the synchronous motor not take current over the same line in varying quantities, would suffice. To render this control perfectly automatic, therefore, small series transformers are inserted in the lines leading to the synchronous motors, feeding a small synchronous motor generator controlling the shunt field of the rotaries. By the combined action of their shunt and series fields the voltage is automatically maintained constant at the commutator brushes of the rotaries, and no hand regulation is required beyond that of readjustment in case the number of rotaries in operation is changed.

The entire construction of the dams, power house and lines has been carried out with the highest engineering skill by the National Contracting Company, of which G. H. Furman is general manager; E. A. Mathews, superintendent, and J. A. Leonard, constructing engineer. The electrical equipment is furnished by the General Electric Company, and the hydraulic equipment by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, O., to which company was confided the entire development contract. It took the Hudson River in its natural condi-

Digitized by Google

tion and turned over to the operating company the plant in running order.

The officers of the Hudson River Power Transmission Company are: General Edmund Hayes, of Buffalo, N. Y., president; R. N. King, president of Stillwell-Bierce & Smith-Vaile Company, of Dayton, O., vice-president; G. M. Furman, Newark, N. J., treasurer; Mr. E. J. Richards, Boston, Mass., secretary; Mr. J. S. O'Shea, superintendent.

Long Distance Transmission of Power.[1]

BY ERNST J. BERG.

CONSIDERING that this paper is read before an Electric Lighting Association, the greater part will be devoted to power transmission for lighting and lighting with incidental motor load. When, in the early '90s, multiphase systems were introduced on a commercial scale, it looked as if the field for the simple single-phase system would be limited; indeed, as if it should be altogether superseded by the new system, yet upon investigation of all properties of the latter it was soon apparent that, although the multiphase systems were superior for some conditions, such as for operation of motors, they could not favorably be compared with the simple alternating current system for lighting. Yet, although this was known and appreciated, already in the early days mistakes have often been made in choosing the best system when contemplating a new installation. The reason for this mistake lies probably in the fact that it is generally assumed that alternating current motors must run on multiphase circuits, and therefore, even if the motor load does not amount to anything, when installing a new plant such a system has been adopted.

Except for very long-distance transmission, as will be discussed later, multiphase systems are really only excusable where power is generated a long distance from its distribution points, and there supplied in a low tension direct current network by means of rotary converters.

At the present stage of the art there can be no question but that every central station man sees the advantages of parallel operation. With this is meant not only parallel running of generators in the station, but also multipole connection of the distribution system, be this direct or alternating current. This feature is most important, as well for economy as for satisfactory operation. From the nature of things it is evident that such distribution system could not be laid out multiphase; therefore, when alternating current is used, single phase should be adopted.

Against this argument it is often stated that in a territory where the load is scattered greatly a secondary network cannot be well laid out, but each customer or set of customers has to be supplied from his own transformer, in which case the distribution is single phase, regardless of whether the system is single phase or multiphase. If a multiphase system is used, single phase mains are brought over to the individual customer or groups of customers. This arrangement may look feasible on paper, particularly so if no investigations are made to determine the potential in these single phase mains.

By a few calculations, however, it is readily found that, although apparently everything is nicely balanced, such system is very often much unbalanced and consequently perfectly unsuited for its purpose. But even were it possible to distribute from a multiphase system with scattered transformers on each main, it is not at all correct to install such a plant, because any well-managed power distribution must some time increase in magnitude, and arrangements should be made so that it can be changed over to a perfect system when need be, which is only possible where each circuit has the same phase; that is, this is only possible with the single-phase distribution from a single-phase generator.

A still further reason for not adopting the multiphase system is that at the present time motors can be operated perfectly satisfactorily from a single phase system; that is, single phase system such as the monocyclic system.

As referred to above, there may, however, be conditions which would warrant a multiphase, or rather, a three-phase, installation, and these are when the distances between generating station and consuming circuit are so great that power cannot be transmitted from one to the other except at the highest possible commercial voltage without too great an expenditure of line copper. Under such conditions the three-phase system, which takes 75 per cent. of the single-phase or two-phase copper, and say about one-half as much copper as the monocyclic system, may be preferable. For shorter distances, however, where it is not necessary to run at the limit of permissible voltage, the apparent saving in copper in the three-phase system over the monocyclic system is of little consequence, since the monocyclic system can be operated with the same amount of copper at a slightly higher voltage. Thus, excepting very long-distance transmissions, the only field for multiphase system is in places where installation of rotary converters are warranted.

The next question of interest is the determination of proper frequency. The 60-cycles or 125-cycles lighting distributions are certainly preferable to the 25 and 40-cycles distributions; indeed, there can be hardly any question of installing anything less than 40 cycles, and such a low frequency can only be warranted by limitations in speed regulation of the prime mover. The tendency seems not to be to have direct connected units as far as possible. Without arguing about this point, it seems that this is correct in most cases, yet undoubtedly it is carried too far in many instances. With very large units such as 1,000 h. p. and more there is no doubt but what the direct connection is better, but we often face propositions where the customer wants to install direct connected slow speed 75 to 100-kilowatt machines. That is, in my opinion, to carry things a little too far, since the slow speed necessitates very large and efficient alternators, with very many poles and engines with exceedingly close speed regulation.

In order to obtain satisfactory parallel operation of alternators, it is necessary that their speed be uniform, and since no steam engine of reciprocating type can be made which gives a perfectly uniform rate of rotation, it is necessary to advise in some cases generators which are most suitable for the engines. It is often possible to build a 25-cycle direct connected alternator which will operate perfectly satisforily from a given steam engine, whereas if a 60-cycle alternator were installed on the same engine, its behavior would be so bad as to make parallel running prohibitive.

The amount of permissible variation is indirectly proportional to the frequency of the alternator connected to the engine, so that, for instance, if a 20-pole alternator was directly connected to a steam engine which gives a speed variation of, say, ½ per cent., and it was desired to get as satisfactory results with a 40-pole alternator, that is, with an alternator giving double frequency, it should be necessary to have ¼ per cent. speed variations.

If belted alternators are used, it is hardly ever necessary to consider lower frequencies than 60 cycles, since the question of speed variation of the engine is, of course, not of such importance as with the direct connected engine, yet it may be given as a rule that cross compound engines should be used wherever possible.

Since incandescent lighting and arc lighting are unsatisfactory for frequencies below 60 cycles, it is evident that we always have to consider either 40, 60 or 125-cycle systems, these being the standard frequencies, and of these the 125 or 60-cycle system should preferably be used, and the 40-cycle only when forced by the speed regulation of the engine.

Regarding the preference of 125 and 60 cycles, it is hard to give any rule. Were it not for the higher speed of the 125-cycle alternators, I believe I favor them, particularly so if the distance of transmission is not too long so that the line inductance may be objectionable, and if the secondary network is not too expensive and too large conductors used. Yet if there is a probability of considerable motor load 60 cycles may be better. In connection with this it may be well to bring out the fact that 125-cycle ironclad alternators are very well suited for parallel operation. Thus, a rule regarding frequencies may be to use as high frequency as possible and where no limitations are imposed by the driving power, use nothing lower than 60 cycles.

With rotary converter installations, the question of frequency is different. There the intention is not to distribute from the multiphase alternating circuit, but only through a direct current network. The frequency of such a system is preferably 25 cycles, since at this frequency the regulation of the engine need not be so extremely good, and the rotaries can be built with relatively slow speed. The three-phase system is, of course, preferable to the two-phase system, since it requires less copper, less lines, less switching arrangements, etc.

[1]Read before the Ohio Electric Light Association.

Digitized by Google

Sometimes, however, it is very desirable to distribute the greater part of the load by means of the rotary converter direct current network, but also to do some lighting in another territory. Under such conditions, it is rather attractive to install a 60-cycle three-phase plant and use 60-cycle rotary converters, in which case the lighting could be directly done from the 60-cycle mains.

Considering, however, the high speed which is necessary in connection with the 60-cycle rotary converter and also the extremely close speed regulation of the engine or turbine driving the alternator, it may not always be a good policy to use them, but would recommend the installation of a frequency changer in connection with the three-phase 25 cycle alternating current generator.

Such frequency changer can be used for transforming three-phase power to single-phase power, 25 cycles to 60 cycles, and any impressed voltage to another. So, for instance, with the frequency changer installed in Brooklyn, power is transformed from 6,600 volts three-phase at 25 cycles to 2,600 volts two-phase power at 62 cycles. This frequency changer is to all appearance an induction motor driven by a synchronous motor. Its capacity is less than the capacity of a corresponding motor generator set and its efficiency is higher.

Finally, regarding the low potential alternating or direct current network from rotary converters, there need hardly be any discussion, since every central station man is fully familiar with the present methods of distributing for lighting.

TELEPHONY AND TELEGRAPHY

Aerial Construction of Fire and Police Telegraph Lines.[1]

BY WILLIAM H. THOMPSON,

Superintendent Fire Alarm and Police Telegraph, Richmond, Va.

OF course the telegraph construction would largely depend upon the service we wish to provide for, and just here I will state that my ideal of a well organized fire and police department is one with a perfect water supply, good apparatus and men, and officered by men of cool judgment and tried bravery, each department of which is run on its merits, solely independent of outside influences with all parties in its favor, and politics out of the question entirely. The importance of the electrical part of these departments cannot be overestimated; that is, where the telegraph and telephones are used.

I know of no better way of illustrating the importance of the fire and police telegraph than to compare it to the commercial telegraph of this age, which pins the whole world together and over which we may send a message and receive an answer from the other side of the world within the time occupied in writing this.

If it is true that "the press is the lever that moves the world," it is no less true that the press is almost entirely dependent upon the commercial telegraph for this power. It is also true of all railroads; in fact, in time of peace or in time of war the telegraph is invaluable.

The best system is none too good for the fire alarm and police telegraph service, and the construction must of necessity be the best, whether aerial or underground. In my opinion, underground is the proper place for these important wires from which so much is expected. However, in cities where limited appropriations will not admit of underground work, and where the superintendents are compelled to maintain their systems overhead among thousands of foreign wires, crossing and recrossing the city wires, I am of the opinion that if in their cities there is no regularly employed city electrician, the superintendent of the fire alarm should, by virtue of his office, have charge, and it should be made his duty to see that no wire, pole or fixture is erected without his knowledge.

What difference does it make if Mr. Jones cannot talk to Mr. Smith over his telephone wire? But let Mr. Jones pull the lever in the fire alarm or police telegraph box, and he fails to get the officers and apparatus until smoke and light or a messenger directs the firemen or police to the scene possibly too late to save valuable property and sometimes life, and the public would soon let you know the difference between the telephone, electric light or power wires, and those of the fire alarm and police telegraph.

There are so many details entering into the calculation of overhead construction that it is almost impossible to lay down any fixed rules for them. There is always present the danger of the fire alarm and police wires getting afoul of high tension wires, causing instruments and fuses to be burnt out at the very time they are most needed.

Another important point of overhead construction is to so construct the line that in case of fire the wires will be as little in the way of the firemen as possible, and also to give these brave men some knowledge of what some of these innocent little wires will do in case of contact with them.

Now that the electric light and power wires, although of a comparatively recent birth, are public necessities and opposition telephone companies are springing up all over the country, in most cases doubling the number of wires we have to contend with, and as the fire departments deal directly with these wires, I see nothing else to do than to advocate the underground system.

[1]Abstract of paper read at Municipal Electricians' Convention, Elmira, N. Y.

Telegraph Revenue Tax Fight in Kansas.

The Atchison, Topeka and Santa Fé Railway Co. has begun a suit in the Federal Court at Topeka, Kan., to compel the Western Union Telegraph Co. to pay the revenue stamp tax on telegrams filed by the railway company. The proceeding is in the form of an injunction to prevent the telegraph company from refusing to accept for transmission messages without the revenue stamps attached. The complaint alleges that the telegraph company violates its contract with the Santa Fé company when it refuses to accept unstamped messages for transmission. The contract in question gives the railroad company reduced rates and free transmission under certain conditons.

EDUCATIONAL

Electricity in Engineering Courses Other Than Electrical.[1]

BY PROF. J. P. JACKSON.

THE present extended use of electricity in industrial undertakings has made a knowledge of its control indispensable to the well rounded engineer.

College courses preparing for the older engineering professions were established while electricity was of small service. Through human inertia these courses have tended to continue on their old lines. The present time, therefore, finds training in electricity far from satisfactory in engineering courses other than electrical.

The work usually assigned is the electricity and magnetism of the general college physics course, with possibly one term on its applications. No time is given to a vigorous advanced treatment of the subject from an engineering standpoint. The college physics course might as well be depended upon to give the requisite training in applied mechanics or thermodynamics.

In addition to the work now usually scheduled, a thorough training in the laws of direct and alternating currents, as they apply to the practical utilization of electricity, should be added. This should be taught by an engineer, and should be assigned time comparable to that given the steam engine, hydraulics and hydraulic machinery, etc. This time could be obtained with advantage by cutting out special work. An outline of such a course is included in this paper.

As scientific knowledge increases, engineering courses must give more time to fundamental principles at the expense of mere technical practice. Hence such courses tend to converge.

If electrical engineering studies are to be satisfactory they must be under the supervision of an engineering department,

[1]Abstract of paper read at the sixth annual meeting of the Society for the Promotion of Engineering Education, Boston, Mass., August, 1898.

Digitized by Google

and should not be taught by instructors in the departments of physics.

Electric Lighting at the Pitman Grove Camp Meeting.

BY BINGHAM HOOD.

THE meeting ground of the New Jersey Methodist Conference, located at Pitman Station, on the West Jersey Railroad, sixteen miles south of Camden, N. J., is visited annually by thousands of persons from all points in the Eastern States.

The grounds, heretofore, have been lighted by oil lamps of the old-fashioned kind, often seen in rural districts. At the commencement of the present season the directors decided to adopt a more modern form of illuminant, and accordingly made a contract with the Gloucester County Electric Company to light the entire grounds with incandescent lights, spaced one hundred feet apart on the main avenues, and one hundred and fifty feet on the less prominent streets. All the lamps to be of thirty-two candle power.

The property is thickly covered with large chestnut, oak, and pine trees, ranging from six inches to five feet at the butt, and planted so thickly that it was impossible to find a stretch clear enough to run from pole to pole, and the association objected to the use of poles at any point, unless they were of iron.

As the contract is only for three months in the year, it was out of the question to go to this expense, and it was decided to make use of what at first promised to make trouble, namely, the trees; and the work was all done by bracketing to these, the wires not being stretched, so that the swaying of the trees does not place any extra strain on the spans. The system has been in service over two months and only one broken wire has resulted, this being caused by a poor factory joint.

The entire job has required about fourteen miles of wire, ranging in size from No. 6 to No. 10 B. & S. gauge; to support this has required over three thousand brackets and insulators, making probably the largest bracketed electric lighting installation in the country.

The fixtures are the simplest, cheapest, and probably the safest that could well be gotten, being nothing but standard porcelain weatherproof sockets, supported directly on the span.

The main part of the grove is laid out like a wheel, with twelve spokes; the hub being the Auditorium, or main meeting building, around which is a circular avenue; radiating from this are twelve avenues, each leading to the outer circle. The avenues and the buildings on them are lighted by a three-wire 208 volt system, supplied from a large General Electric converter at the centre.

Outside of this wheel is the larger part of the ground, to light which, without using a large number of transformers, or heavy secondary wires, presented the most difficulties.

It was finally decided to, figuratively speaking, take the bull by the horns and adapt a different system, the one finally fixed upon being a series incandescent system, but differing from any other in having no street fixtures, shunt boxes or other cut-outs.

To describe this system is the main object of this paper, as the same system can be used in many places where the income would not be sufficient to pay for shunt boxes or other fixtures.

Starting at a centre, each circuit passes through a telltale and switch, which will be described later. From this the wire goes to the first lamp; the circuit being here broken by introducing a common porcelain knob, such as is used in all line work; one end of the wire passing around the groove and twisted, the other end going through the screw hole and twisted. (See Fig. 1.) Across this insulator is bridged a weatherproof socket and lamp; the joints being left bare, the purpose of which will be described later. The wire then follows in the same way from lamp to lamp, as in all series systems, until ten lamps are on each circuit.

The primary voltage is 1,080, each lamp being 106 volts special series burning railway pattern. This leaves 20 volts for the line loss, each circuit being about 4,000 feet long and of No. 10 wire.

At the beginning of each circuit is a cut-out box, containing a plain porcelain receptacle, in which is a short circuited attachment plug, acting as a switch; and a solenoid coil. The core of this coil fits loosely and upon being raised by the current, separates a pair of contacts, opening a secondary circuit, fed from the large transformer spoken of before, and supplying a 10 candle power red lamp. See Fig. 2.

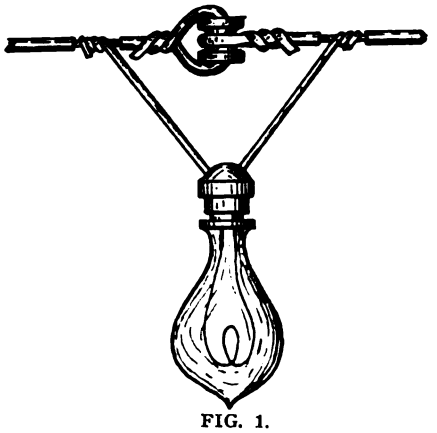


FIG. 1.

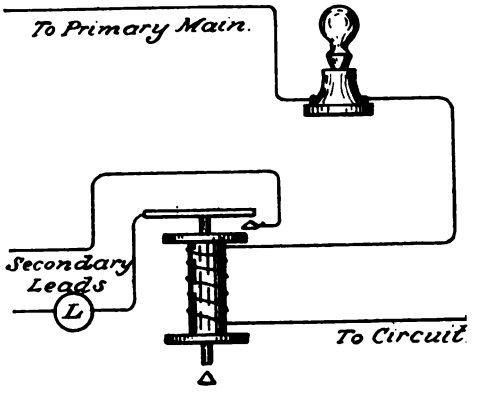


FIG. 2.

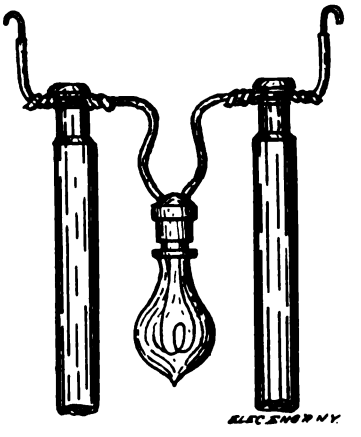


FIG. 3.

CAMP LIGHTING WITH SERIES INCANDESCENT LAMPS.

The inspector has only to look at these indicators to see if each circuit is burning. If the signal lamp is burning a circuit is open, the trouble being usually a burnt-out or stolen lamp. He starts over the circuit provided with a short-circuiting hook, consisting of two insulating sticks, on each of which is fastened a hook made of No. 6 wire; bridged across these sticks is a piece of flexible cord and a socket and lamp (see Fig. 3). By placing one hook on each joint, where the socket is connected, the lamp between the hooks will light when the bad lamp is reached, and is then easily repaired.

The only trouble arising from this system has been that when a lamp burns out it will generally explode, creating an arc, which follows up through the lamp base and socket, destroying the socket. This, however, is a small expense, as a new socket and lamp only means an expense of forty-one cents.

These circuits have been burning a total of over four hundred hours, and only three lamps have been burned out, out of a total of 160. The average cost of erection has been but three dollars and sixty cents per lamp, against twenty dollars for the standard series system, and has given equally as good service. Of course a system of this kind would hardly answer where the service is the year around, but for a summer service is without an equal, considering the low first cost and small repair account.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 2, 1888.*]

Vol. XXVI. NEW YORK, SEPTEMBER 1, 1898. No. 539.

Novel and Extending Uses of the Storage Battery.

AN answer similar to that of Benjamin Franklin to the question "What is the value of a child?" that "It will some day become a man," was singularly applicable a few years ago to the query as to the use of the storage battery. And the infant of that time has certainly not disappointed us, as evidenced by its wonderful development and rapid growth during the last four years, when the total weight of plates installed has increased tenfold, while the weight and cost of each individual cell have been materially reduced. The web of litigation has fortunately been swept away, the correct use of the battery has been discovered and new fields of usefulness have been opened for it.

In discussing the recent developments in the applications of storage batteries before the Engineers' Club of Philadelphia, Mr. Joseph Appleton made the significant statement that the installation by the Chicago Edison Company of a storage battery, the plates of which weigh over a million pounds, capable of delivering 2,000 horse power for one hour, has conclusively shown that "the storage battery of to-day is not an experiment or a toy, but a piece of apparatus constructed on proper mechanical, electrical and chemical lines, and one which is as much of a factor in the generation and distribution of electrical energy as boiler, engine and dynamo."

As one of the most important of recent applications of the storage battery is mentioned, its connection with the development of water powers for the generation, transmission and distribution of electrical energy for power, lighting and manufacturing purposes. This is illustrated by the installation of a very interesting plant lately by the Buffalo Street Railway Company, as described in these pages, operated in connection with a booster which compounds it to any desired extent. The aim, of course, is to keep the rotary converters as fully loaded as possible, in order to get the greatest benefit from the Niagara Falls power.

The advantages of the use of storage batteries for elevator service are too evident to require any argument and are admirably summed up by Mr. Appleton as follows: "Smaller generating plant necessary; only one unit need be run, instead of two, with consequent saving in labor; greater economy of operation, due to plant being run at a constant and efficient load, instead of a varying one; smaller depreciation on plant, due to entire absence of heavy loads being suddenly thrown on the same; greater reliability on account of battery being ready to take entire load in case of emergency."

Another recent and widely different use of the storage battery is its employment in telephone exchanges, where they are centralized to replace the batteries formerly installed with each subscriber's instrument. While this application is not yet universal or widespread, the opinion has been expressed by well known telephone engineers that the time is not far distant when the value of the storage battery for the above purpose will be generally recognized by every telephone exchange manager in the country.

By far the most extensive and interesting use of the storage battery in recent years, however, and one for which there seems to be a limitless field in the near future, is the furnishing of power to electric vehicles. It has been shown by recent trials and developments that electricity is the ideal agent for carriage propulsion, having the following advantages over the use of any oil or gas: It is safe; can be easily handled and controlled; the electric motor makes less noise and creates less vibration than oil or gas motors; the absence of heat and smell, and its small cost of operation. Besides these the electric current possesses other advantages which might be mentioned to show its superiority, but the above will suffice in view of the fact that as a motive power for horseless vehicles it has already taken the lead. Thus we see a new and vast field opened for the storage battery which is being exploited to its fullest extent in America where we are making up rapidly for our reticence in the past. No better evidence of this can be found than in the splendid equipment of the charging station of the Electric Vehicle Company, of New York, described on other pages in this issue, and the increasing demand for electric vehicles in that and other American cities. The new use means additional employment for the electric current, and the Edison Company of New York are planning to provide charging plugs in the streets all over the city, so that, if necessary, a cab can pull alongside a charging plug and fill up. It will besides, impart a boom to the carriage tire and other industries, and above all, it will probably have the much desired effect of giving us a low cost, highly efficient and light-weight storage battery.

The Limitations of Power Transmission.

WE have before us a catalogue of one of the best known electric manufacturing companies in the country, in which are enumerated plants, with detailed data, aggregating a combined capacity of one-quarter of a million horse power of polyphase electric transmission apparatus. By far the largest percentage of this work is carried out with the aid of water power as the initial source of energy. The unabated increase in the utilization of such powers both here and abroad made possible by the aid of electrical transmission ought to be sufficient evidence of the financial success achieved by such plants in the past, and it is safe to say that no halt will be called in the march of progress begun so auspiciously. It is hardly to be expected that every enterprise of this kind should have proved an unqualified success, but we can look with complacency on the few instances in which trouble has been experienced, and we do this in the belief that by pointing out the mistakes that have been made a service will be rendered to those who are now operating or who contemplate the installation of water power transmission plants.

The few instances referred to may be simmered down to two general causes, namely, that some companies have "bitten off more than they can chew," while others have suffered from bad initial engineering, or again, from both causes combined. For instance, we know of a case in the East where a company during the past month was unable to maintain the normal candle power of its lamps owing to the severe drought and a defective dam. Another case is that of the Redlands Electric Light and Power Company, California, which claims attention on account of the prominence of the plant. This company, it seems had contracted to furnish the city of Riverside, Cal., with 200 h. p. The company has not been able to do this of late, and the city authorities have notified the company that the city is suffering great damage and loss from the lack of power, and will hold the company responsible. They even speak of forfeiting the $15,000 bond of the company. Here again the trouble is due to the lack of water in the mountains. But what will be more a matter of general surprise is the rumor that the Folsom-Sacramento power transmission plant is to be supplemented by a steam plant in order to carry the load.

These three examples, we believe, can all be included under the causes given above. The first duty of every company distributing electric power, for whatever purpose intended, is to provide for uninterrupted service. Without this no customer will be satisfied, and without satisfied customers there can be no

Digitized by Google

progress from a financial standpoint. It does not by any means follow that every water power can be successfully transmitted to long distances. The conditions which determine success, however, can in every case be fairly well prognosticated, but such prognostication ought to be left in the hands of most competent engineers. Nor does it follow that a water power transmission is subject to any other general laws as to loading than is a steam power plant. In fact, the advantage, if any, is on the side of the latter, for whereas a steam plant can, in case of emergency, be forced considerbly beyond its normal capacity for extended periods of time, such is not the case with a water power plant. It follows, therefore, that to load up a water power plant beyond its capacity is a practice which will sooner or later bring on trouble. All these troubles, however, can be avoided by judicial management, and the examples we have cited above seem to us merely to indicate that had due precautions been taken the unfavorable results experienced could have been avoided. Certain it is that the art of electric power transmission is now so well established and its limitations so thoroughly understood that there can be no excuse for failure in the future.

Municipal Ownership Agitation and Its Antidote.

IN a recent issue we had occasion to dwell on the report of the Detroit municipal electric lighting commission, an analysis of which showed that even that much-vaunted example of municipal ownership could hardly be said to have fulfilled the expectations of its projectors. Indeed the commission acknowledged as much in its report. While the agitation for municipal proprietorship is still raging, we believe that the evidence now rapidly accumulating is beginning to have a salutary effect, and where precipitancy was formerly the rule, a conservative hesitancy is now observable on the part of many communities. The agitation being still alive, however, it is well to guard against its prime cause, and that is, it seems to us, bad service on the part of the electric lighting companies. A flood of light is thrown on this phase of the subject in the paper of E. P. Roberts, read before the Ohio Electric Light Association. Mr. Roberts having acted on behalf of several municipalities in their disputes with private lighting companies, speaks by the card. What did he find? In most cases the companies were furnishing a good commercial article, so to speak, and living up to the spirit of the contract. In other cases, the contrary fact was noted. Sometimes considerable indignation was expressed at preliminary information obtained by him without having notified the lighting company that he was in town, and the greatest objection was made by the president of the company giving the poorest service! Where the company was living up to its contract, the result of Mr. Roberts' investigation resulted in a much better feeling toward the company on the part of the municipal lighting committees, and the agitators against the local companies were practically disarmed. The history of human error finds constant repetition in spite of that history. The proverbial leniency and even indifference of the American citizen to public abuses have their limits, and what would be tolerated indefinitely in some cases will in others arouse speedy resentment. Street illumination is among the latter. The average citizen will worry along with dirty streets and bad water for a lifetime, but when it comes to street lighting he demands his money's worth or wants to know the reason why. We hope the lesson embodied in Mr. Roberts' paper will not be lost. There are many companies who have long since learned that a permanent and prosperous business can only be built up by fair dealing with the public, but there are still some who apparently have not yet learned that lesson.

The New Element, Etherion.

THOUGH Mr. Charles F. Brush has for quite an extended period abandoned the field of electrical invention, he has of late devoted himself to other lines of research, and some of the results of his work are embodied in a paper presented by him before the American Association for the Advancement of Science at its meeting in Boston last week. In that paper Mr. Brush describes the properties of a remarkable gas discovered by him and which he has named "etherion." The properties of this gas are described in Mr. Brush's paper, printed elsewhere on this page, and, as will be noted, Mr. Brush hazards the conjecture that possibly etherion may be found to be identical with the so-called ether. No doubt some similarity will be found, because even ordinary gases correspond to some of the properties of the ether, but we imagine that the crucial test of this new gas will show it to lack one essential characteristic of the ether, and that is high elasticity. But even without the hope of identifying etherion and its co-ordinate gases with the ether, the new discovery in itself is one of unquestioned interest and importance.

Single Phase and Multiphase Motors on Lighting Circuits.

THERE are to-day many central station managers who see the necessity of extending their facilities to meet the demands of their customers for electric power, but who are in a quandary as to just what system to adopt, taking into consideration all conditions. It is one phase of this problem that Mr. E. J. Berg discusses in his paper read before the Ohio Electric Light Association, which will be found elsewhere in this issue. In order that our readers may not draw false conclusions from Mr. Berg's statements, it may be well to point out that he limits the problem under discussion to power transmission for lighting and lighting with incidental motor load; hence, the paper does not refer to conditions where motor load is of first importance.

Etherion.[1]

BY CHARLES F. BRUSH.

THE gas is a constituent of the atmosphere and is found absorbed in many substances. Its chief characteristic thus far experimentally determined is enormous heat conductivity at low pressure. Mr. Brush showed that its conductivity even when mixed with a large excess of other gases is something like a hundred times that of hydrogen, the best gaseous conductor heretofore known; and conjectures that the conductivity of the pure gas will be found a thousand or more times that of hydrogen. He discovered the gas nearly a year and a half ago, while looking for occluded hydrogen in glass. He found not only hydrogen, but something of vastly greater importance. After many months of experiment he has recently effected partial separation of the new gas from the air by diffusion. In the first diffusion the heat conductivity of air was increased something like a hundredfold. Mr. Brush expects to obtain the gas in a state of approximate purity by successive diffusions of air.

A table of figures was exhibited, showing the molecular weight, density, specific heat, relative mean molecular velocity, and heat conductivity of the gases whose heat-conducting curves appeared in the chart; and attention was directed to the evident close relationship between the heat-conductivity and molecular velocity of the gases. From this relationship some other properties of the new gas were deduced. Taking the heat conductivity of the new gas at a hundred times that of hydrogen, a very conservative estimate, its mean molecular velocity at freezing temperature was calculated to be more than a hundred miles per second, and its density only a thousandth part that of hydrogen; while the specific heat was found to be 6,000 times greater than that of hydrogen, the substance having the greatest specific heat heretofore known.

It was shown that a gas having attributes anything like those cited could not possibly be confined to the earth's atmosphere; and hence the new gas, being found here, probably extends indefinitely into space and constitutes an intersteller atmosphere. In recognition of this probability Mr. Brush has named the new gas etherion, meaning "high in the heavens."

Some evidence was cited tending to show that etherion is a mixture of at least two different gases; and Mr. Brush hazarded the conjecture that on further investigation three or more gases will be found, forming one or more periodic groups of new elements all very much lighter than hydrogen. The possibility that etherion may be found to be identical with the so-called ether was touched upon, and Mr. Brush expressed the hope that it would be found to account for at least some of the phenomena heretofore attributed to the ether.

[1]Read before the A. A. A. S. Abstract.

Digitized by Google

ELECTRIC TRANSPORTATION

The Cabs and Central Station of the Electric Vehicle Company of New York.

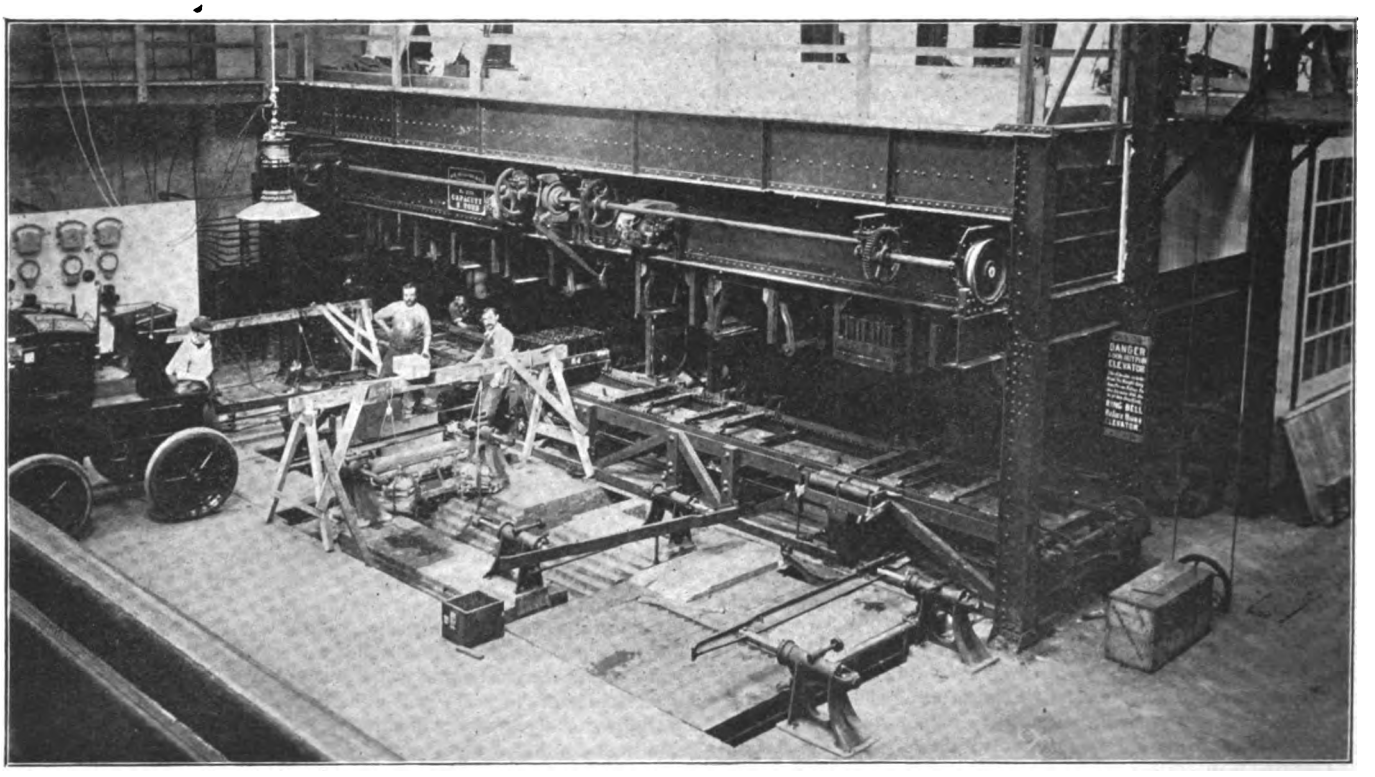
OF all the recent applications of electricity, there is perhaps none which exceeds in interest nor one which offers greater possibilities for future expansion than that of electric vehicles. The progress made in this art abroad within recent years has acted as an incentive on this side of the Atlantic, and the work accomplished in the United States in the brief space of a few years has been most remarkable and encouraging. Not alone have the types of American horseless vehicles eclipsed their European prototypes, but every detail has received the stamp of American ingenuity and foresight. In recent issues we have described the products of several American and foreign manufacturers, which will bear out the truth of the above statements by a close study of the apparatus and methods employed. But not alone in the design of vehicles, but, as will be seen by the description of the New York Electric Vehicle Station, given below, the entire service has been brought to a high state of perfection in this country.

It was eighteen months ago that Messrs. Morris & Salom, of Philadelphia, built twelve electric vehicles for service in the city of New York. These were in successful operation for over a year, when the demand for horseless vehicles far exceeded the supply, and led to the organization of a large corporation called the Electric Vehicle Company, whose intention it was to give to the metropolis as complete and satisfactory electric cab service as could be furnished. To carry this into effect 100 electric vehicles were ordered, very much after the pattern of the original twelve, with the necessary changes suggested by a year's severe service, running over all classes of pavement.

The next step was to erect a charging station having ample storage capacity for the carriages and fulfilling numerous conditions in order to give economical and in every way satisfactory service. Among these might be mentioned convenience of location for rendering service to the greatest number of patrons; in other words, a spot centrally situated on the Island of Manhattan within easy reach of the majority of theatres and not too far distant from the business and residence portions, as well as railroad stations and ferries.

Such a place was found at Broadway, between Fifty-second and Fifty-third streets, extending through to Seventh avenue, which was formerly used for a skating rink and bicycle academy. This building, which is shown among the accompanying illustrations, is about 200 feet long and has a frontage of 75 feet on Broadway and the avenue. This enormous area has now been transformed to suit the requirements of the electric cab service, and, as will be seen, it is admirably situated for this purpose on account of its large and unobstructed interior.

The offices of the company are located on the main floor at the Broadway end, and space has been set aside at the office end for the drivers' room and repair shop. The remainder of the ground floor is divided into two main portions, one-half being occupied by the battery room, which measures 37 by 100 feet. At one end of this room is set the large electric crane for handling batteries, as explained more fully below. Above this space is a large room intended for the storage of unused vehicles, with the exception of those which are on the floor below, charging or being cleaned.



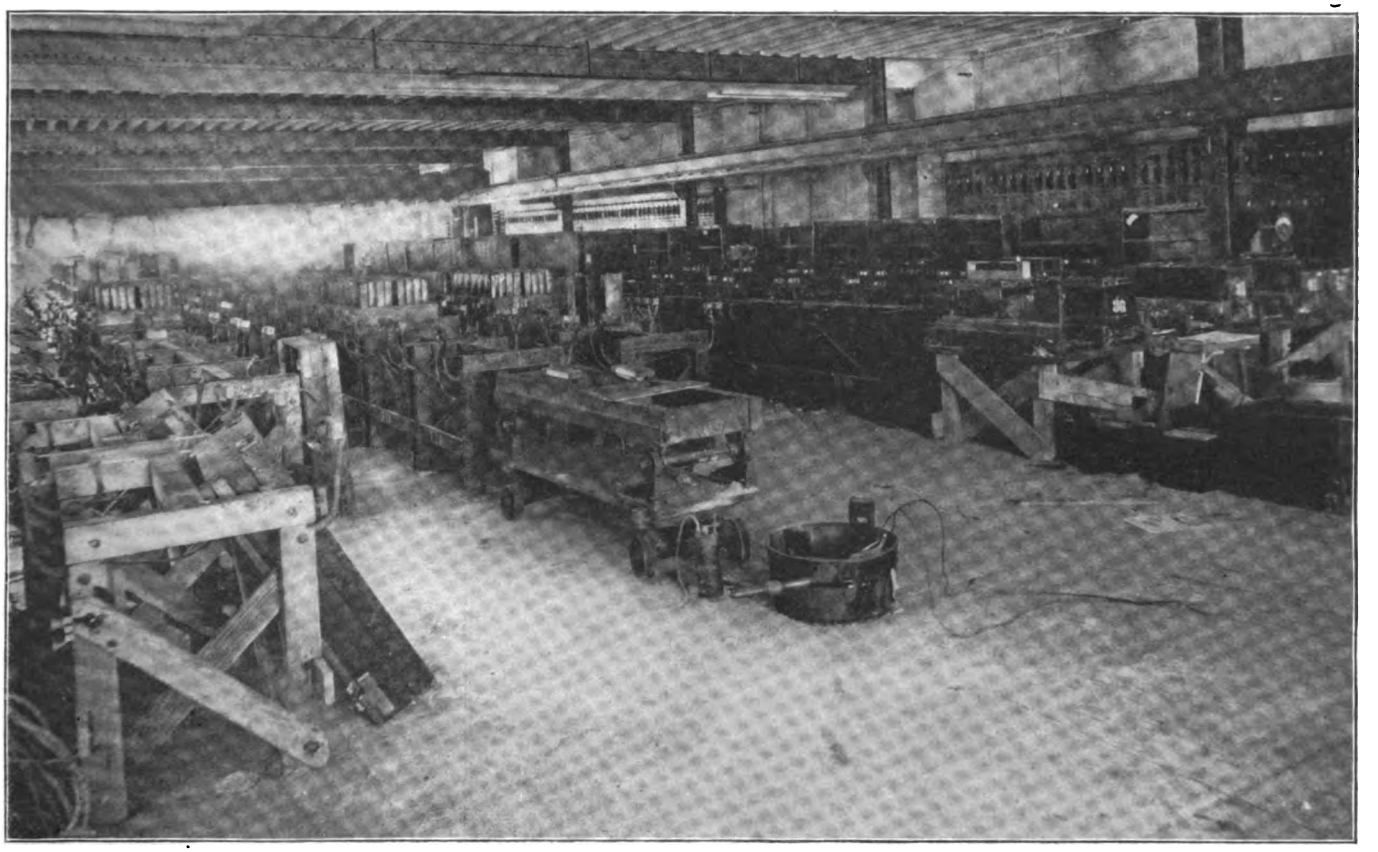
INTERIOR VIEW OF CHARGING STATION OF THE ELECTRIC VEHICLE CO., NEW YORK, SHOWING VEHICLE, HYDRAULIC RAMS, CRANE AND BATTERY TABLES.

In order to elevate the batteries to this room two large elevators have been installed. The carriage loading machinery, which will be referred to later, is located at the front end of the battery room. The cab, as it comes in from service, is backed up into this space, is automatically unloaded, and when not to be used immediately, is set aside for cleaning. If, however, it is to be immediately used again the discharged batteries are automatically taken out and a new set inserted, all within a space of about two minutes—less time than it takes to unharness a horse.

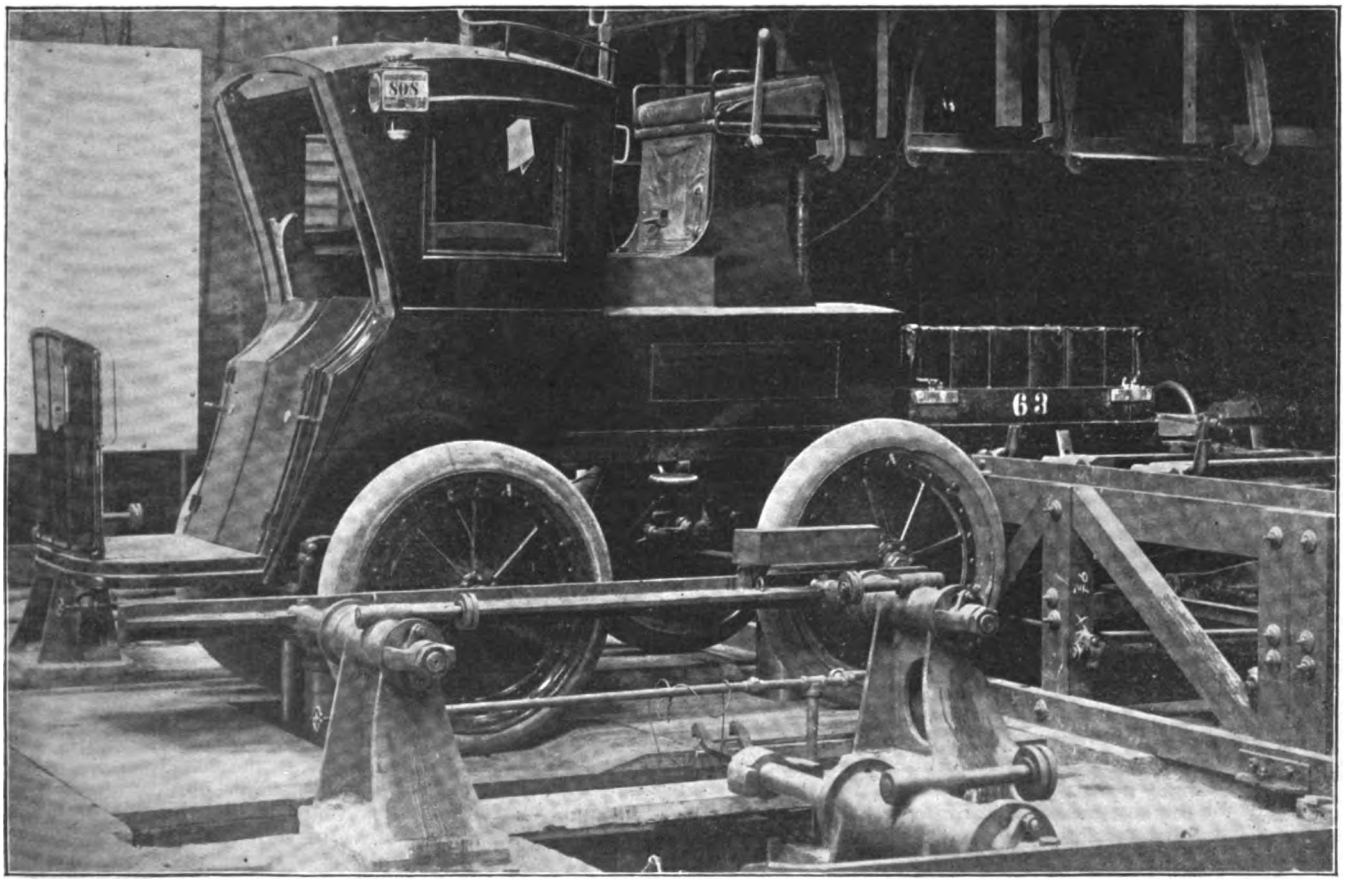
Before going into the detailed description of the equipment of this modern electric stable, on which a vast amount of skill and care has been bestowed in order to have perfect arrangement for the vehicles and batteries, a brief description of the cabs themselves as well as their equipment will prove of interest.

The electric cab, as stated above, was patterned after the type originally designed by Messrs. Morris & Salom, and resembles the ordinary hansom cabs, with the exception that it has a large compartment behind the carriage proper for holding the batteries. It has been the object of the designers to produce a vehicle embodying all features of the most modern carriages and to sacri-

Digitized by Google



INTERIOR OF BATTERY ROOM, IN CHARGING STATION OF THE ELECTRIC VEHICLE COMPANY, NEW YORK.



ELECTRIC HANSOM OF THE ELECTRIC VEHICLE COMPANY, NEW YORK, SHOWING HYDRAULIC RAM FOR SIDE ALIGNMENT AND BATTERY IN POSITION FOR LOADING.

Digitized by Google

fice if possible none of their graceful lines and lightness. The chief difference, of course, is that this electric cab has four wheels instead of two, and tires which bespeak luxurious comfort at first sight. The tires are no less than 5 inches in diameter and pumped to 60 pounds pressure. The vehicle, including the battery, weighs nearly 3,000 pounds, has a wheel base of 4 feet 7½ inches and a gauge of both front and rear wheels of 4 feet 10 inches. The front wheels support the carriage body and the two rear wheels are used for steering purposes.

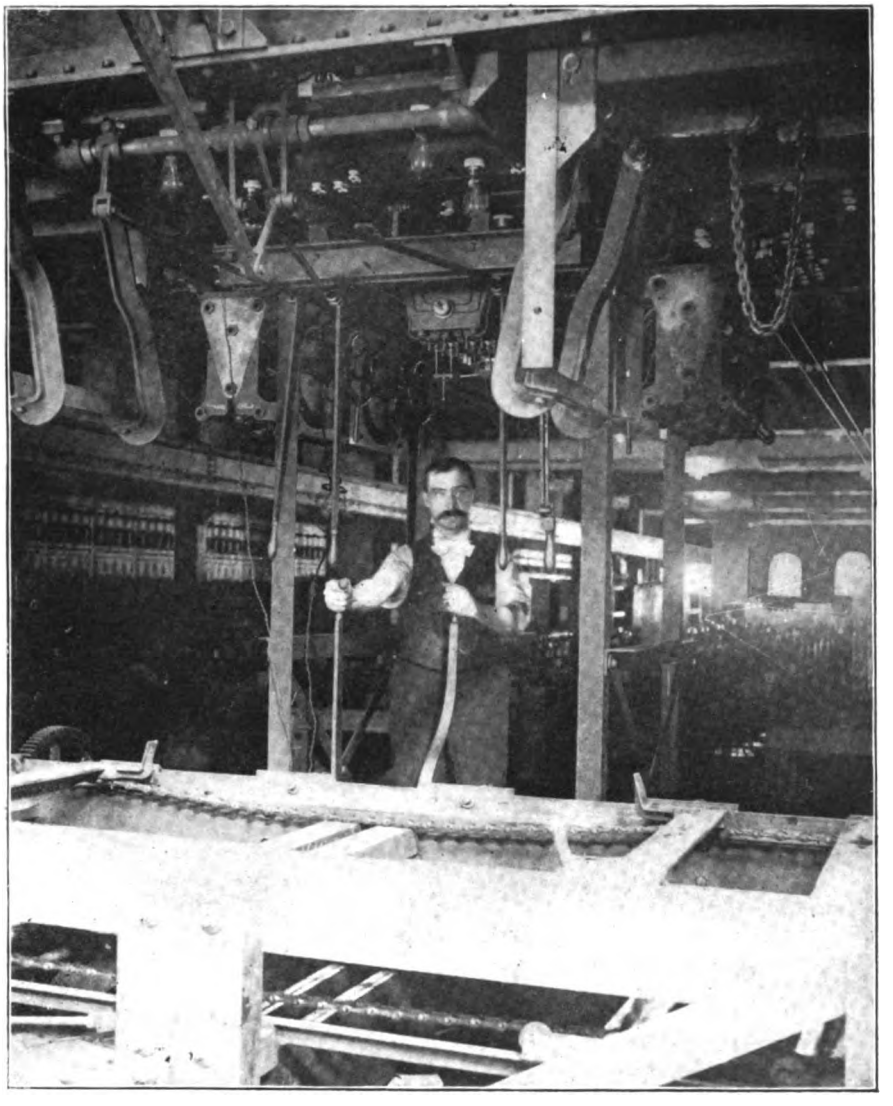
The construction of these wheels is claimed to be superior to those of any other make, two ⅛" stamped steel plates serving in lieu of spokes. These hubs are fastened to the inside edges of the metal rim and diverge towards the hub, forming a hollow space within. The diameter of the space, including the tires, is 36 inches, all wheels run in roller bearings and have double ball thrusts. Each set of wheels is driven by a motor, and there is no gearing connecting them.

MOTORS.

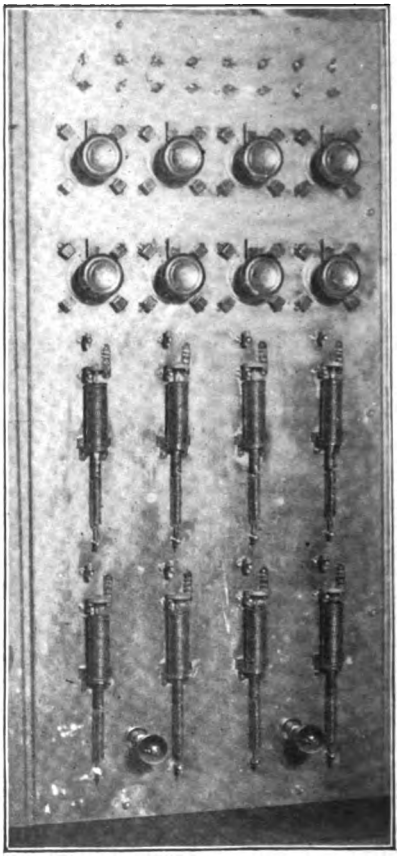
The motors used in these carriages were built by the Westinghouse Electric and Manufacturing Company and are of a special waterproof ironclad construction, being very similar to ordinary street car motors. With a pressure of 80 volts at the battery terminals each motor develops 2 h. p., or 4 h. p. combined. The motors are geared to the driving mechanism in a manner similar to that employed for railroad motors, as is clearly shown in the illustration of the suspension mechanism of the carriage. The gears are so fitted to the wheel that the transmission of the strains is almost directly to the rim instead of passing through the web or spokes. Several rubber cushions and springs placed between the motor and the frame give the arrangement great flexibility and prevent unnecessary jarring. The steering mechanism of the vehicle is of an improved design. As will be seen in the illustration, the steering lever, which is situated in front of the driver's seat, is 26 inches in length and is moved forward and backward by the operator. The independence of each set of wheels is a notable feature in these vehicles, and the great flexibility of every portion of the mechanism is noteworthy.

STORAGE BATTERY EQUIPMENT.

Each vehicle is equipped with 48 storage cells of the Electric Storage Battery Company's manufacture. It has a rated output of 100 ampere hours at the normal discharge rate. Each cell is encased in a rubber jar and consists of two Manchester positive and three chloride negative plates and weighs 26 pounds, making the total weight of the battery carried by each vehicle 1,248 pounds. The cells are placed on wooden trays, which fit into the battery compartment in back of the vehicle, into which they can be inserted as a unit, a matter of much importance and convenience.



OPERATOR IN POSITION FOR REMOVING A SET OF BATTERIES FROM A VEHICLE.



BATTERY CHARGING PANEL.

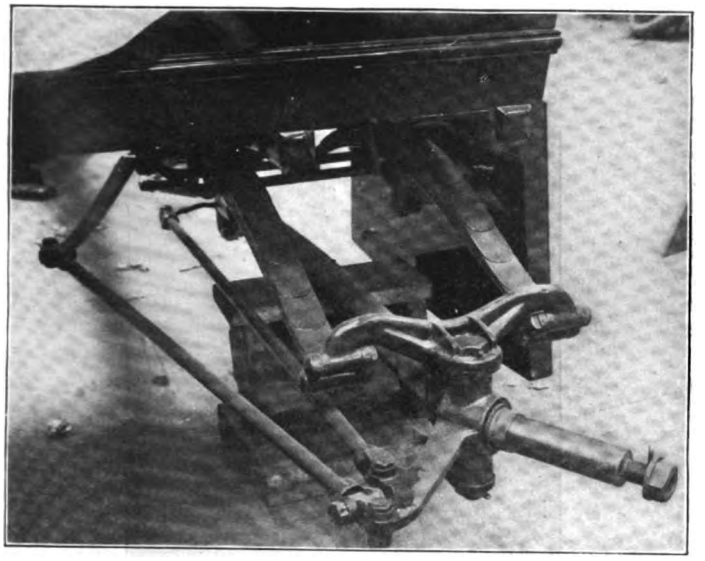
The connections between the cells are burnt so as to insure good and permanent contact. When shoved into place the battery makes connection automatically with the motor and controller by means of contact springs, which are clearly seen in the engraving showing the back of the vehicle open for inspection with the battery in position. This portion of the carriage is suitably lined so as to prevent any spilled acid from attacking the woodwork, and is provided with channels to drain off the acid.

STEERING MECHANISM.

Besides the steering lever described above, the operator has

Digitized by Google

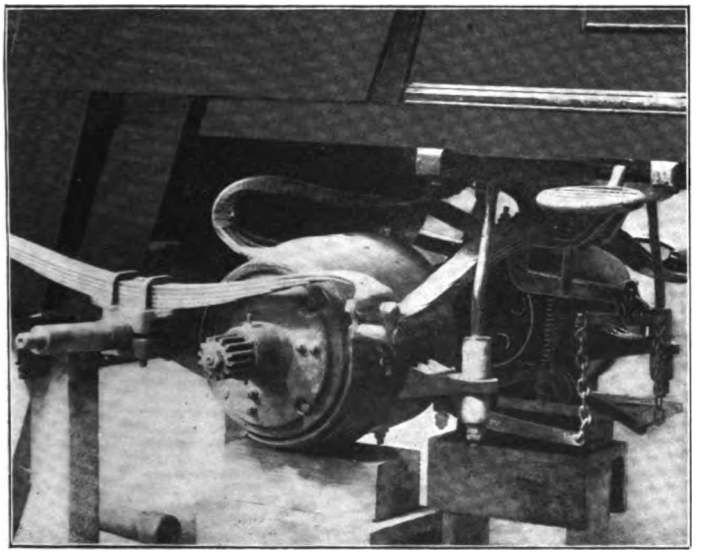
within easy reach the controller switch, which imparts a rotary motion to the controller cylinder, as well as a reversing switch. This is provided with an interlocking arrangement, which prevents the carriage from being reversed until the speed controller has been brought to a zero condition. The reversing switch is operated by the driver's foot, and ordinarily is in the position to go ahead. The controller allows three speeds to be obtained,



STEERING MECHANISM OF ELECTRIC VEHICLE.

namely, six, nine and fifteen miles per hour. The diagrams shown herewith illustrate the connection between motor, batteries and controller. The series parallel control is used, and with one charge of battery twenty-five to thirty-five miles of road can be traversed.

Besides the above switches there is an emergency switch for the purpose of shutting off instantly all current from the motor. This is under control by a kick of the operator's foot; a kick

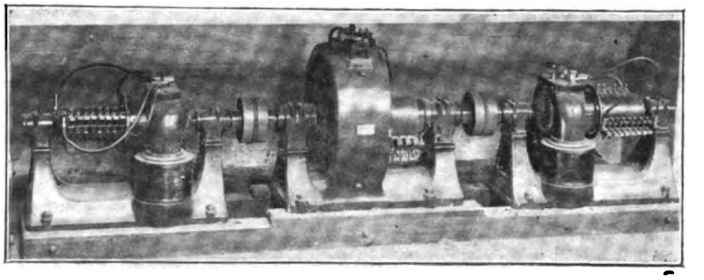


MOTOR SUSPENSION AND BRAKE MECHANISM.

removes a key handle and opens the circuit. When this key has been removed no outsider can turn on the current and cause a runaway. The brakes are applied by means of a foot lever and are of the double acting shoe type, as shown.

It may appear from the number of switches to be operated that the motorman will have his hands full, but it has been demonstrated that the design and location of the controlling mechanism enable the operator to have perfect control of the vehicle and steer it easily and rapidly past any obstacle or through narrow passages.

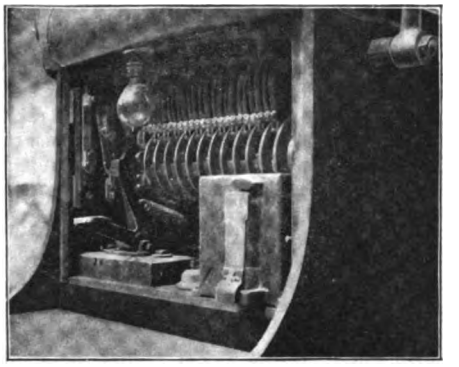
It may be of interest to note that every part of the vehicle as well as the entire station equipment has been duplicated, so that in case of a breakdown the service will not be interrupted. Another important feature is that the battery may be charged with-



BOOSTER DYNAMO IN ELECTRIC VEHICLE CO.'S STATION.

out removing it from the vehicle. This is accomplished by means of receptacles and plugs in the battery box and on the charging table.

The hansoms above described are intended to carry two passengers, the operator and light baggage. The company, however, have delivery wagons and other styles of carriages in oper-

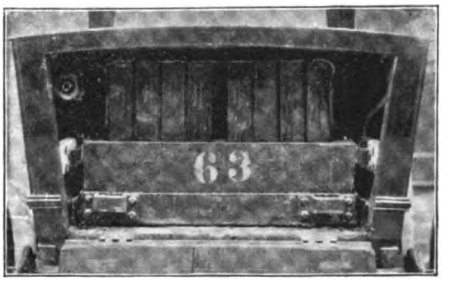


MOTOR CONTROLLER UNDER OPERATOR'S SEAT.

ation in the city and are now having built broughams and electric 'busses for heavy passenger service.

METHOD OF CHARGING THE STORAGE BATTERIES.

The charging of the batteries is done from the local Edison three-wire system, 350,000 c. m. conductors entering the building at the Broadway side. Three pole switches on the north wall connect them to 1,500,000 c. m. cables, which are led to the main switchboard. The switchboard, shown in the engraving, consists of nine white marble panels each 3 ft. 1½ in. in width, making

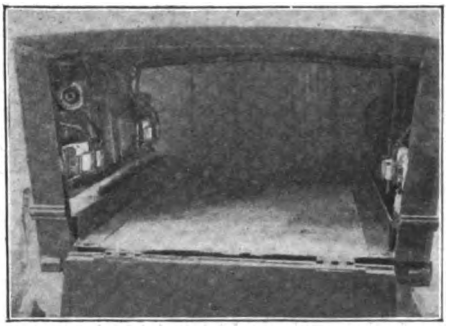


BATTERIES IN POSITION IN BACK OF VEHICLE.

the total length of the switchboard 28 ft. 1½ in. From the switchboard a number of busses are run to the charging panels, each bus being of a different potential, for reasons explained later. Four of the panels of this board control the positive side of the charging busses and four are connected to the negative side of the circuit. Switches connect these charging busses to the battery racks, each positive and negative bus being connected to its respective panel by means of a single pole switch, an under and overload I. T. E. circuit breaker and a large rheostat for regulat-

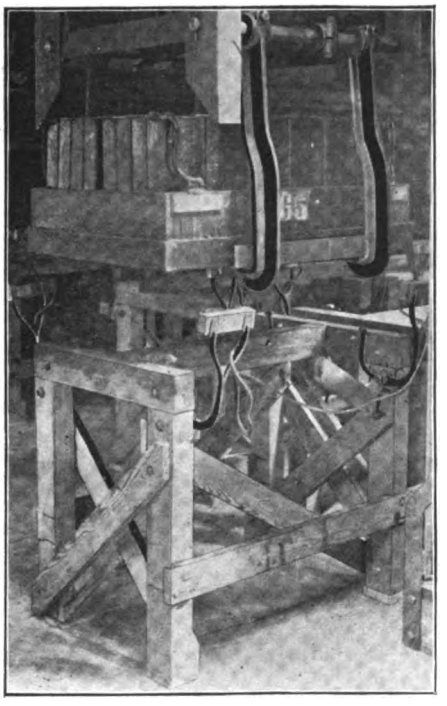
Digitized by Google

ing the potential. The first and fifth busses, however, by means of a double-pole double-throw switch, can be connected with a booster dynamo of 7½ h. p. capacity at 220 volts pressure, built by the Western Electric Company. One of these boosters is used on the positive and one on the negative bus. These ma-



CONNECTING SPRINGS IN BATTERY COMPARTMENT OF VEHICLE.

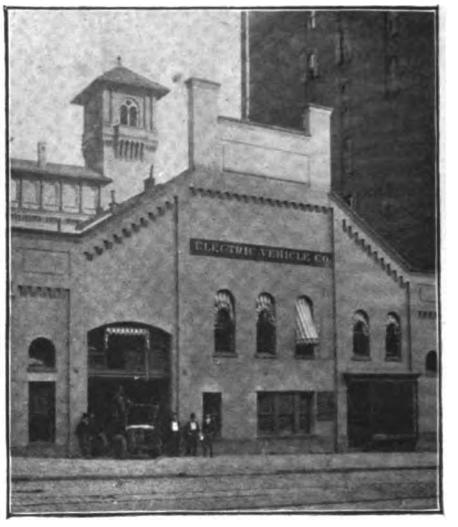
chines have a capacity of 200 amperes at from 5 to 75 volts, and are placed on a wooden platform above the switchboard. The remaining panel at the right is used for light and power instruments and switches. Before following through the operation of charging a set of batteries, it should be stated that the company have facilities for charging 150 sets of batteries of 48 cells each, or 50 per cent. more than is required when all vehicles are in service. The batteries when not in use are placed on the separate trays referred to above and stored away in the battery racks, of which there are eight rows on the main floor, which is covered with cement. Thus each tray of cells has its own compartment built of heavy and well-seasoned yellow pine timber, coated with water



CHARGING TABLE AND GRAPPLING DEVICES.

and acid-proof paint. No metal was used in the construction of these racks. They are so arranged that access can easily be had to any part without removing it from its compartment. When a battery is being placed on a charging table by means of the crane it is automatically connected with it and the charging circuit by an ingeniously constructed lever. The two sections of each set of cells are connected together in series, and the two remaining terminals are connected to the Edison terminals by means of switches referred to above. The purpose of the four charging boosters is as follows: When a battery returns to the station it is connected to the lowest of the busses. This is done by a four-point switch on the switchboard which connects the battery to any of the busses through a form of solenoid ammeter. These meters are provided with telltale indicators in the form of colored lamps set at the charging current, which is 20 amperes low and 50 amperes high.

We are now ready to follow a set of batteries through a charging operation. It is first placed on the charging table and connected to the lower pressure, which will allow the proper charging current to pass into the battery. At this charge its voltage rises and the current decreases. When it drops to the point at which the indicator is set the lamp is lighted and the switchboard operator knows that it is time to switch the battery on the higher

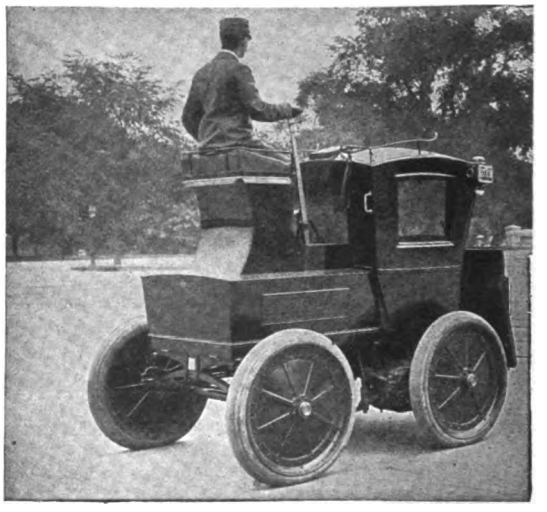


EXTERIOR VIEW OF CHARGING STATION, ELECTRIC VEHICLE CO., NEW YORK.

bus. The current is then increased by the higher voltage, and the signal lamp is cut out until the current drops again, and so the operation proceeds. If it is desired to charge the battery quickly it is only necessary to connect it at once to one of the higher busses, but this will have the effect of having the current fall to zero when the battery is fully charged.

Naturally, the charging of the batteries creates fumes, and these are withdrawn by a 40-inch exhaust fan, which is placed on the upper floor and is driven by an electric motor.

It may be further stated that the batteries can be charged from connecting plugs located at the forward end of the battery



VIEW OF ELECTRIC VEHICLE COMPANY'S CAB.

room without removing them from the battery box of the vehicle.

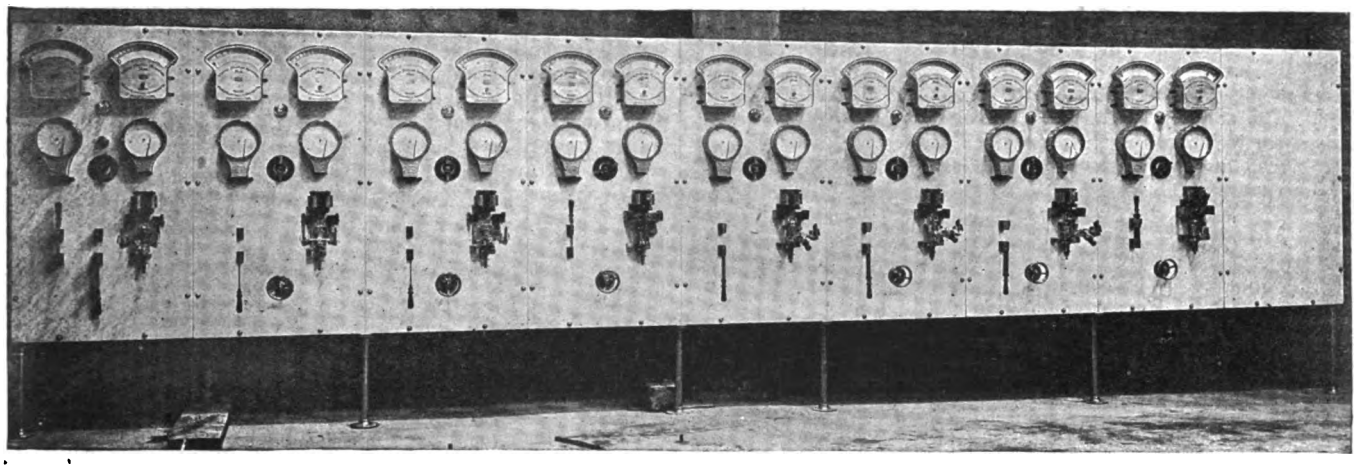
APPARATUS FOR HANDLING THE BATTERIES.

In the design and construction of the manipulating devices for the vehicles and batteries the greatest ingenuity and foresight

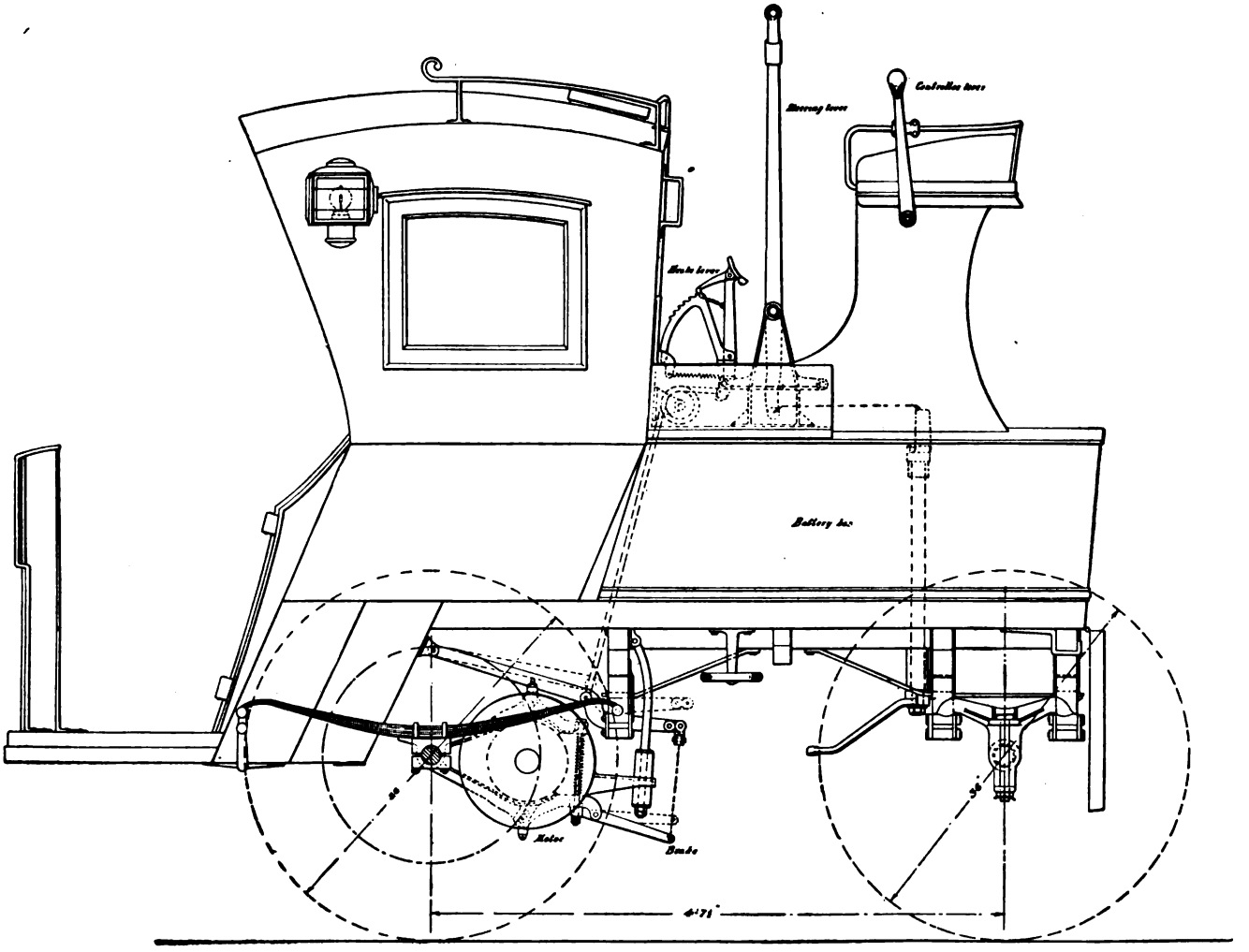
Digitized by Google

has been displayed, and the system as it stands to-day leaves nothing to be desired in simplicity and rapidity of operation.

It has been the aim to reduce the labor and expense connected with the handling of the vehicles and batteries to a minimum by employing automatic devices throughout, which can be handled by unskilled labor. The manner in which this has been accomplished is simply marvellous, one man being able to unload and load a carriage with batteries by means of a set of levers from his position in the operating cab, suspended from the centre of the electric crane. This crane, which runs the entire length of the battery room, has a capacity of eight tons, and was built by William Sellers & Co., Philadelphia. It is operated by Westinghouse four-pole motors, each of 5 h. p. capacity, receiving current from trolley wires suspended from the crane bridge. On each side of the operating cab are suspended four electric battery hoists, each having a capacity of one ton. These hoists are suspended directly over the battery racks and carry a grappling device consisting of two heavy iron jaws, as shown in the engraving. These jaws are operated by a set of chains, one for hoisting and the other for imparting motion to the grappling arms. Each hoisting drum is operated by a worm-geared electric motor.



MAIN SWITCHBOARD IN STATION OF ELECTRIC VEHICLE COMPANY, NEW YORK.



SIDE VIEW OF ELECTRIC VEHICLE, SHOWING DETAILS OF CONSTRUCTION.

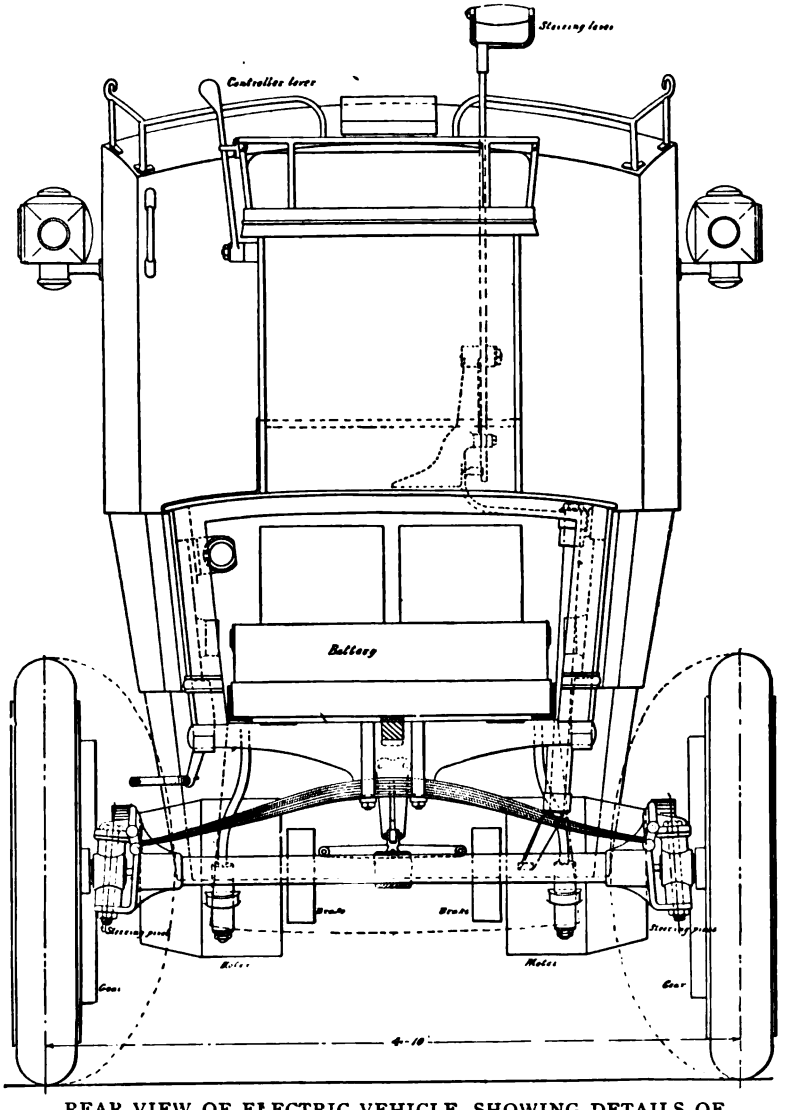
When a vehicle comes into the station and has been placed in position by specially designed hydraulic machinery, described

Digitized by Google

further on, the grappling device runs out and withdraws the empty battery to the conveyor, which consists of heavy iron bars with upward projections, into which the battery tray fits. This loading transfer table, which is electrically operated and is in reality a link-conveying machine, extends across the entire front of the battery room. The conveyor consists of eight sections, and as soon as the empty tray has been deposited it is moved one section until it is opposite the vehicle, when a charged battery is pushed into place by the grappling device, explained above. The contacts in the vehicle are made by springs already referred to, which rub against the sides of the tray.

The empty battery is now carried by one of the lifting clutches and placed upon the charging table, and a charged one is deposited on the conveyor for the next vehicle, which comes in to be supplied with a charged set of cells. This all seems like a very simple operation, and so it is, for, as stated above, one operator can perform it in the short period of two minutes. But it must be remembered that a great deal of time and money was expended in designing special machinery for procuring these facilities, principal among which should be mentioned the hydraulic rams which place the vehicle in the exact position for unloading and loading.

In front of the conveyor table are two car-loading platforms on a level with the cement floor of the building. These platforms are mounted on wheels and can be moved in line with the conveyor table. The platform is divided into two parts, each having four wheels and being perfectly aligned and centered by means of weights. In this way each pair of wheels of a vehicle situated on the platform has an independent car to itself and the entire vehicle can therefore be shifted in any direction until it is in perfect alignment with the conveyor table. As the weight of the battery in the vehicle depresses the platform several inches, another alignment is necessary after the cells have been removed. This removal is accomplished by means of an hydraulic ram centrally situated in back of the conveyor table, which can be clearly seen in several of the illustrations. This hydraulic pulling and pushing ram, as it might be appropriately called, has its cylinder on a level with the conveyor table, across which the long plunger projects. When used for unloading a vehicle this plunger comes forward and engages a pair of hooks with sockets in the end of the tray, pulling the latter out of its compartment on the return stroke. When loading a vehicle the plunger simply pushes the tray into position. The hooks are released from the sockets on the trap by means of a lever, which can be operated by the man in the crane cab.



REAR VIEW OF ELECTRIC VEHICLE, SHOWING DETAILS OF CONSTRUCTION.

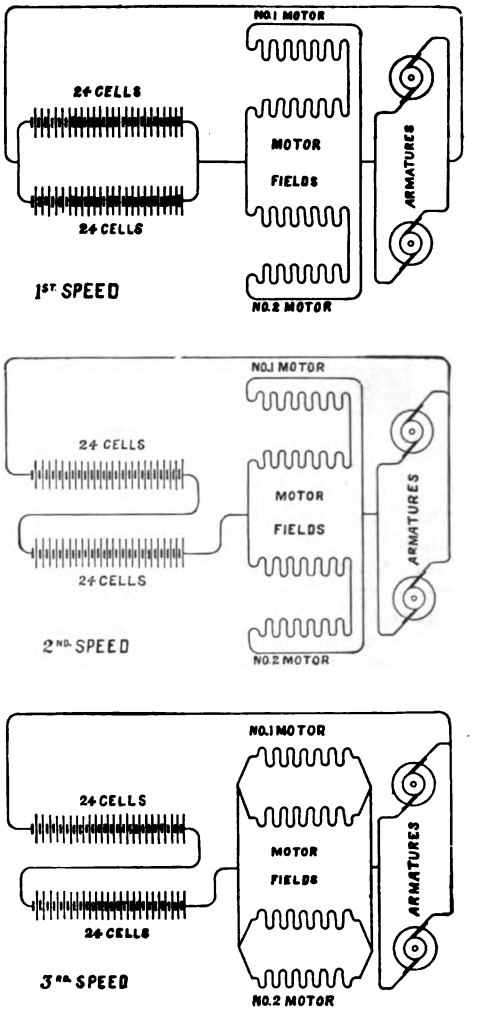


DIAGRAM OF CONTROLLER CONNECTIONS FOR THREE SPEEDS.

The hydraulic ram for lifting the vehicle consists of two vertical cylinders built on a solid brick foundation beneath the platforms on which the vehicle is run. The plungers of these cylinders are attached to raising bars, and when actuated project through openings in the platform, one plunger raising the body of the vehicle and the other the battery compartment. After this operation the other hydraulic rams located on each side of the platform come into action for the side alignment of the vehicle. The bars of these machines connected to plungers of horizontally placed cylinders act closely to the hub centres of the wheels and extend so far as to strike the steering and driving hubs at about the same time. These bars, used for centreing the vehicle, have different movements, the one opposite the front wheel having a

Digitized by Google

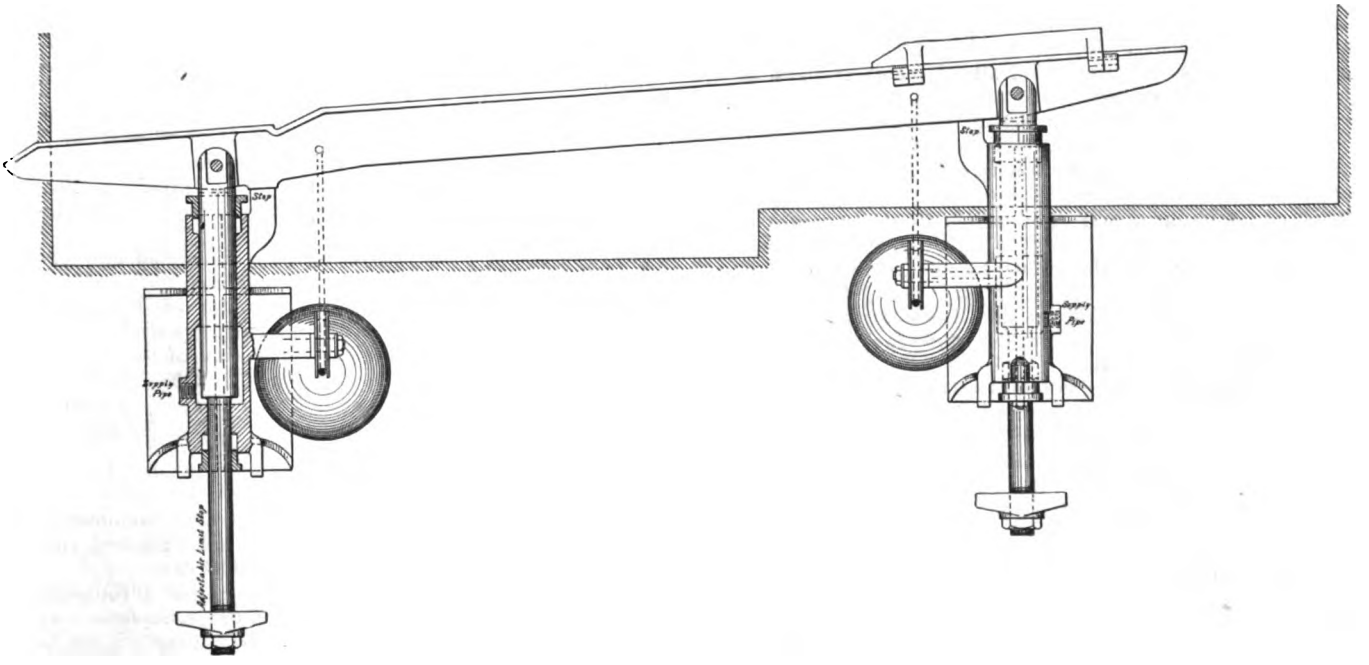
travel of 11 inches and the other one 7 inches. The rams are returned to their normal position by heavy weights, and the amount of their travel is predetermined for placing the vehicle into the required position, both in regard to height as well as getting it centrally located in front of the conveyor table. All the hydraulic machinery is operated by means of an electrically driven Gould triplex pump. This pump feeds at a pressure of 150 pounds to the square inch, a pressure tank 3 feet in diameter and 5 feet deep sunk into the floor between the loading platforms. Pipes extend from this to the several controlling valves of the machinery described above.

The two vehicle elevators, which are operated by C. & C. electric motors, have a capacity of 2½ tons and operate at a speed of 100 feet per minute. Between these elevators an emergency loading station is located, supplied with machinery for loading and unloading the vehicles similar to that in the main room, with the exception of the side centering device.

CONCENTRATION OF CONTROL, INSPECTION OF VEHICLES AND COST OF SERVICE.

As will be seen from the above description, perfect concentration of control has been established by locating all operating levers within easy reach the operator in the crane cab and enabling him to see the signal lights on the switchboard and operate the switches thereon. Nevertheless, every piece of moving machinery is provided with interlocking and safety devices, so as to prevent any accident in case the operator should neglect his duty. Besides, as already stated, the automatic features of the entire equipment enable one man to operate it with rapidity and thus insure economy and efficiency of service. Each vehicle before it leaves the station and after it returns is carefully inspected by competent men and thoroughly cleaned, and the battery equipments, as well as the vehicles and other apparatus, are constantly kept in repair and improved upon. Tests of efficiency are frequently made, and an extensive series of them are now in course of preparation, the results of which will undoubtedly prove of interest and value.

The public of the metropolis, recognizing and appreciating the high efficiency of the service, are freely patronizing the electric cabs. Besides transporting the passenger with far greater dispatch, the fare charged is only about one-half that charged for vehicles drawn by horses. For each passenger the fare is 30 cents for the first mile and 15 cents for each succeeding one, or the cab may be hired per hour for a reasonable sum. The cabs are located at the most prominent corners and thoroughfares, or may be summoned by telephone or messenger from the station. As a larger number and greater variety of vehicles are built and the streets of the city improved, the service will grow in public favor and patronage. This is surely to be hoped and expected after one has gained an idea of the enormous amount of time and money which has been expended by the promoters. First among those to whom credit should be given is the chief engineer, Mr. G. Herbert Condict, whose general design was followed in the construction of the station and the various details, assisted by Mr. A. W. Gilbert, the constructing engineer. The officers of this enterprising company are: Mr. Isaac L. Rice, acting president; Mr. Frederic Vieweg, general manager, and Mr. G. Herbert Condict, chief engineer.



HYDRAULIC RAM FOR SIDE ALIGNMENT.—PLAN VIEW.

SOCIETY & CLUB NOTES

Boston Meeting of the American Street Railway Association.

The meeting of the Association will last from September 6 to 10 inclusive, headquarters being at the Brunswick, and sessions being held at the Charitable Mechanics' Building, where the exhibits will be. There are to be several entertainments and excursions, including a clambake at Nantasket Beach, trips to Plymouth, Concord and Lexington, and a trolley ride to Norumbega Park. The papers to be read are as follows: Tuesday—"Comparative Earnings and Economy of Operation between Single and Double Truck Cars for City Use," Richard McCulloch, Electrical Engineer, Cass Avenue and Citizens' Street Railway Companies, St. Louis, Mo.; "Municipal Ownership of Street Railways." Wednesday—"Maintenance and Equipment of Electric Cars for Street Railways," M. S. Hopkins, Electrician, Columbus Street Railway Company; "Carrying of United States Mail Matter on Street Railways," W. S. Dimmock, General Superintendent, Omaha & Council Bluffs Railway and Bridge Co. Thursday—"To What Extent Should Street Railway Companies Engage in the Amusement Business?" Walton H. Holmes, General Manager, Metropolitan Street Railway Company, Kansas City, Mo.; "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," Frederick D. Perkins, Electrical Engineer, Toledo Traction Company. Friday—"Cost of Electric Power for Street Railways at Switchboard, both Steam and Water," R. W. Conant, Electrical Engineer, Boston Elevated R. R. Co.; Report of Committee on Standing Rules for Government of Conductors and Motormen.

Digitized by Google

The Fiftieth Anniversary Meeting of the American Association for the Advancement of Science.

(From Our Special Correspondent.)

THE fiftieth anniversary meeting of the American Association for the Advancement of Science began at Boston on Monday, August 22, with a session of the Council of the Association. At 10 a. m. the general meeting was held in Huntington Hall of the Massachusetts Institute of Technology. From the number of delegates present and the character of the papers presented this meeting was without doubt the most important ever held by the association. Delegates representing all branches of scientific activity were present from the great educational centres of this country, besides many who came from Canada and Europe to represent their various countries.

The arrangements, which were in charge of the local committee, were superb, and nothing was spared to give the members of the Association the best the city could afford in every detail. The various clubs about the city gave the delegates special attention for their entertainment, together with the excursions made to the beautiful suburbs of the city. Boston fairly outdid itself.

The first general session of the Association was held on Monday at 10 a. m. in Huntington Hall. The large auditorium was crowded to listen to the various addresses. The meeting was called to order by the retiring president, Wolcott Gibbs, of Newport, R. I. After prayer by the Rt. Rev. William Lawrence, Bishop of Massachusetts, addresses of welcome were delivered by His Excellency, Roger Wolcott, Governor of Massachusetts; Josiah Quincy, Mayor of Boston, and President Craft, of the Massachusetts Institute of Technology.

Governor Wolcott was in fine voice, and throughout the whole of his forcible address was listened to with marked attention by his large audience. He extended a most cordial greeting to the Association and welcomed all its members back to the Association's place of birth. He also spoke of the great work being done by scientists in their search for truth and urged upon the Association the continuance of its noble pursuit.

Mayor Quincy said that Boston was the host of the Association at this, its semi-centennial, and was grateful for the privilege of entertaining it, fully appreciating the favor conferred by holding its anniversary in Boston. He also dwelt upon the practical application of the principles of science to municipal government.

President Crafts, on behalf of the Massachusetts Institute of Technology, welcomed the delegates and spoke of the advantages of scientific research.

The chairman of the local committee announced that the social part of the programme had been much enlarged, and included excursions to various points of interest about the city. He said that it was the intention of the committee to make Wednesday and Friday gala days, and that arrangements had been perfected for the continuous entertainment of the members of the Association.

A message was read from the Russian Geological Committee of St. Petersburg, sending to the American Association the good wishes and congratulations of that society.

After the reports of several committees were passed upon the first general session was closed.

The various sections then took up the reading and discussion of papers.

No general session was held by the Association on Monday afternoon, but the nine different sections met and papers were presented by the vice-president of each section, which bore directly upon the work of the respective sections. One of the most interesting papers was that by Professor Smith on "The Electric Current in Organic Chemistry." In this paper Professor Smith outlined the growth of this branch of electricity, and said that it had been a stepping-stone to great advances in other branches of electrical science. The use of the current in electrolytic solutions had in many cases led to a complete reversal of many previous ideas as to the composition of important solutions and had been of immense advantage to the industrial side of the question.

TUESDAY, AUGUST 23.

Tuesday was a day of serious work for the members of the Association. Each of the sessions held two meetings devoted to the presentation of special scientific subjects. It was found that all of the papers could not be brought forward, and as a result a large proportion were not read before the Association.

The most important announcement of the day was that of Mr. Charles F. Brush, who gave in detail the process of discovery of a new gas in the atmosphere, which he at present terms etherion.[1]

The afternoon excursion about Boston Harbor was the most largely attended excursion of the day. In the evening from 9 until 11 the Public Library was open to the members. Mayor Quincy gave a dinner at the Union Club to the officers and guests of the Association. Among the foreign guests were Prof. Chaney, delegate of the French Government; Prof. Cooke and Prof. Howard, of London; Prof. Galbraith, of Toronto, and M. Paul du Chaillu, the African explorer.

WEDNESDAY, AUGUST 24.

Wednesday was Salem day. Several excursions were made to this historic point, and, as a consequence, very little work was done at the headquarters of the association. The first party started at 7:45 in the morning. This party was composed of engineers and sanitarians, and went to the Metropolitan Water Works at Clinton. A party of eighty went to Lawrence, where several big print works were visited.

The chief event of the day, the Salem excursion, left early for this place. The sail down the bay afforded a fine view of the harbor and islands.

A landing was made at Salem Willows, where the visitors became the guests of the Essex Institute of Salem. Here the local committee served the scientists with an old-fashioned New England shore dinner. The party then divided into groups and, under the guidance of the local committee, were shown the points of historic interest about the place.

THURSDAY, AUGUST 25.

The members began to gather as early as nine o'clock, and spent a busy day at the Massachusetts Institute of Technology.

Besides the regular sectional meetings, the day's programme included several features deserving of special note. Paul du Chaillu, the African explorer, delivered an address on "The Norsemen, the Conquerors of Britain," in which he dwelt on the importance of this race in the history of civilization, criticising the historians for the unimportant place they give this people in the annals of history.

By Thursday evening several of the sections had finished their labors and disbanded for the current meeting.

The Council of the Association elected Prof. Edward Orton president for the coming year, and decided upon Columbus, O., as the place for the next annual convention of the Association. Prof. Edward Orton is State Geologist of Ohio; he was graduated from Harvard University and has held many important positions in scientific work. He has had charge of the work of the State Survey since 1881.

FRIDAY, AUGUST 26.

Friday was known as Cambridge Day. The members of the Association were by special invitation of the President and Fellows guests of Harvard University for that day.

All departments of the University were open throughout the day for inspection by the members of the Association, and in many departments special exhibitions were given for the benefit of the members. In the evening President Elliot delivered a timely and scholarly address to the guests in Saunder's Theatre. His subject was, "The War's Lessons." He defined his position as not opposed to the army and navy, but in favor of larger expenditure for the constructive arts. He said that the modern soldier was a scientist, and he must know how to use weapons of precision and scientific instruments intelligently. "This war," he continued, "brought out in a very forcible manner the fact that the wider the education of the people, the more free industries open to the people, the greater is the military power."

SATURDAY, AUGUST 27.

The last general meeting of the convention was held this morning at 10:30 o'clock. Many famous scientists were upon the platform. Many reports were read, the most interesting being that of the permanent secretary. This showed that 903 delegates had registered during the convention, 158 being from New York. Canada, England, France, Germany, Brazil, Japan and Australia

[1]See page 203.

Digitized by Google

were each represented by one or more delegates. Four hundred and forty-three papers had been read, and almost $6,000 surplus was in the treasury of the Association.

Classified Digest of U. S. Electrical Patents Issued August 16, 1898.

Batteries, Primary:—

PRIMARY BATTERY. Walter Rowbotham, London, England, 609,-298. Filed Feb. 24, 1898. A new construction and arrangement of battery whereby local action is quite avoided when the battery is at rest, and in details intended to permit of the battery being continuously charged and discharged of its working fluids while using iron instead of zinc for the active plates.

COMBINED BATTERY AND ELECTRIC CELL. Jules Celestin, Dagoneau, Beaufort, France, 609,142. Filed Jan. 15, 1895. A cell containing sulfate of copper, an interior cell contained therein and comprising a rectangular framework and membranes secured upon this framework and constituting the walls of the interior cell, a zinc element and dilute sulfuric acid contained in the interior cell, suspension bars adapted to suspend the articles to be plated, circuit connections between the zinc plate and the bars and one or more perforated lead plates in the interior cell upon which a copper deposit will be made.

Conductors, Conduits and Insulators:—

METHOD OF AND APPARATUS FOR MAKING ELECTRICAL INSULATION CONDUITS. Hugo Gallinowsky, St. Louis, Mo., assignor to the Lithosite Mfg. Co., same place, 609,094. Filed Nov. 15, 1897. Consists in submerging fibrous material in a bath of oxychlorid cement, saturating the material from both sides, winding it on a mandrel before the cement completely sets, by suspending it by one end so that the mandrel will slip out.

MEANS FOR FASTENING INSULATOR PINS TO CROSS-ARMS. Loron Mitchell, Augusta, Ga., 609,288. Filed May 10, 1898. An insulator pin having its shank provided with a groove triangular in cross-section, and a locking device carried by this groove and adapted for frictional engagement with the wall of an opening into which the shank of the pin may be passed.

ELECTRICAL CONDUIT BOX. Hubert Krantz, New York, 609,356. Filed May 6, 1898. A split conduit box provided with corresponding semicircular rims on the two parts of the box to form the outlet openings for the conduits, in combination with closing discs held in place by the two parts of the box when fitted together.

Controlling Devices:—

ELECTRIC CONTROLLER. Joseph D. Forrer, Johnstown, Pa., assignor to the Steel Motor Co., Ohio, 609,092. Filed July 11, 1898. A pair of concentric shafts, operating levers for each shaft, means for preventing the removal of one of the levers except when it is at a predetermined position, and independent means for preventing the lever from being removed except when the other shaft is at a predetermined position.

ELECTRIC CIRCUIT CONTROLLER. Nikola Tesla, New York, 609,245. Filed Dec. 2, 1897. The combination with a receptacle of a conductor or series of spaced conductors, a nozzle or tube for directing a jet or stream of fluid against the same, the nozzle and conductor being capable of movement relatively to each other, and means for maintaining a circulation of conducting fluid, contained in the receptacle, through the nozzle, and dependent for operation upon such relative movement. (Described in the issue of Aug. 25.)

ELECTRIC CIRCUIT CONTROLLER. Nikola Tesla, New York, 609,-246. Filed Feb. 28, 1898. Similar to above.

ELECTRIC CIRCUIT CONTROLLER. Nikola Tesla, New York, 609,-247. Filed March 12, 1898. Similar to above.

ELECTRIC CIRCUIT CONTROLLER. Nikola Tesla, New York, 609,248. Filed March 12, 1898. Similar to above.

ELECTRIC CIRCUIT CONTROLLER. Nikola Tesla, New York, 609,249. Filed March 12, 1898. Similar to above.

ELECTRIC CIRCUIT CONTROLLER. Nikola Tesla, New York, 609,-251. Filed June 3, 1897. Renewed June 15, 1898. Similar to 609,245.

SYSTEM OF CONTROL OF ELECTRIC MOTORS. Edwin R. Gill, Englewood, N. J., assignor to the Invention Developing Co., New Jersey, 609,274. Filed April 4, 1898. A system whereby the power regulation is primarily dependent upon movement of the motor itself, thus insuring any desired degree of generation of counter electromotive force before a predetermined resistance has been cut out.

Dynamos and Motors:

ELECTRIC MOTOR. Rudolf Eickemeyer, Yonkers, N. Y., 609,015. Filed Jan. 5, 1891. A reversible electric motor coupled to the hoisting mechanism, provided with a system of field coils, and one or more governing coils, and means for supplying the governing coils, with independent electric currents opposite in direction to those carried by the field coils, and means for furnishing to the governing coils, currents which are effective only when the motor and elevator are moving too rapidly.

Miscellaneous:—

ELECTRIC ELEVATOR. Rudolf Eickemeyer, Yonkers, N. Y., 609,016. Filed May 3, 1892. The combination with the traveling car body or platform of a compound motor, a resistance in shunt relation to the series coil of said motor, and a solenoid automatically controlling the magnetizing power of said series field coil by gradually short-circuiting said resistance.

MEANS FOR INDICATING A SHIP'S ROLL. James J. Hicks and Giles H. Zeal, London, England; said Zeal assignor to said Hicks, 609,231. Filed Nov. 18, 1897. An annular tubular glass chamber half filled with mercury, and means for carrying such chamber and oscillating it in a vertical plane.

ELECTRICAL IGNITER FOR GAS ENGINES. Nikola Tesla, New York, N. Y., 609,250. Filed Feb. 17, 1897. Renewed June 15, 1898. Depends for its operation upon the production of a sudden electric discharge at a given instant or at predetermined intervals of time.

WINDING MACHINE. Emmett J. Satterwhite, Falls City, Neb., assignor of two-thirds to Fred. E. Farington, Charles W. Farington and Theodoric F. Sullivan, of Richardson County, Neb., 609,300. Filed Sept. 10, 1897. A new and improved winding machine arranged to accurately wind the desired amount of wire on a core of the desired length.

SHIP'S COMPASS. Robert Oliver, New York, N. Y., 609,363. Filed Sept. 11, 1897. A compass card having straight, permanent bar magnets arranged thereon, parallel to a north and south meridian and permanent U-shaped, or horseshoe, magnets arranged with their legs on opposite sides of the equatorial line.

Railways and Appliances:—

MOTOR CAR. Charles Otis Palmer, Cleveland, O., 609,043. Filed April 18, 1894. Renewed Jan. 25, 1898. Means for automatically maintaining a uniform tension of the driving rope notwithstanding the driven pulley is being moved at the same time the power is being transmitted.

ELECTRIC BRAKE. Ernest B. Skinner, Ogden, Utah, 609,124. Filed Oct. 30, 1897. Consists of a solenoid and its plunger for operating the brake mechanism; a second solenoid disposed at right angles to the first and a lever connected at one end of the plunger of the smaller solenoid and at the other end to links carrying a shoe, used for braking.

ELECTRICAL TRACTION. William Kingsland, Llandudno, England, 609,188. Filed Dec. 23, 1897. A continuous main electrical conductor, and sectional working conductors from which the motor car directly collects the current, and a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary sectional conductor the current is passed from the main conductor to the sectional working conductor.

ELECTRIC RAIL BOND. Joseph S. Tucker, Chicago, Ill., 609,252. Filed Jan. 20, 1897. A rail bond comprising a conductor having its ends provided with enlarged tapered heads provided at their smaller ends with flanges, in combination with bushings adapted to encircle these heads.

SWITCH AND SWITCH OPERATING MECHANISM. James P. Orr and George H. Fugh, Pittsburg, Pa., 609,292. Filed Nov. 9, 1897. A railway switch, comprising a tongue, a track section, electrical means for moving the tongue and track section vertically, one section being moved downward as the other is moved upward and means carried by a car for opening and closing the electrical circuit.

Telegraphs:—

ELECTRIC TELEGRAPHY. Oliver Joseph Lodge, Liverpool, England, 609,154. Filed Feb. 1, 1898. (Similar to the system described in The Electrical Engineer, Feb. 24, 1898.)

FIRE ALARM. Hilmar Tersling, Copenhagen, Denmark, assignor to Johannes Caroe, Niels Schmitd and Emil Schiemann, of same place, 609,309. Filed March 15, 1897. A fire alarm constructed to reduce to a minimum the danger of sounding false alarms, and it is characterized by a mechanical alarm sounding in the immediate vicinity, and by a mechanism moving in unison with the mechanical alarm, whereby an electrical circuit is influenced to sound a distant alarm.

Telephones:—

TELEPHONE SYSTEM. Alfred F. Swan, Bayonne, N. J., 609,173. Filed Sept. 29, 1897. A movable switch arm operated from the switch barrel and adapted to cut the talking set in and out.

TELEPHONE SYSTEM. Charles E. Egan, Burton L. Lawton and Ernest C. Wilcox, Meriden, Conn., 609,229. Filed April 9, 1897. Spring jacks, each provided with a central telephone connecting spring, a generator connecting spring and a subscriber's communicating spring; a plunger fitted to reciprocate in each spring jack to engage either of the first two named springs, and a pair of connected plugs, each fitted to operate a plunger and provided with a metallic nib fitted to engage a subscriber's communicating spring.

TELEPHONIC MEASURED-SERVICE SYSTEM. William W. Dean, Boston, Mass., assignor to the American Bell Telephone Co., of same place, 609,331. Filed Nov. 16, 1897. Consists in combining a two-party main telephone circuit with two call-registering or call-counting mechanisms placed at the central station, and each operated to produce a record only when their electromagnets are excited by two successive current impulses.

TELEPHONE REPEATER OR RELAY. John Stone Stone, Boston, Mass., assignor to the American Bell Telephone Co., of same place, 609,374. Filed Dec. 29, 1897. An improved telephone relay adapted to be placed at the junction of two telephone circuits extending from different terminal stations for the purpose of automatically repeating the conversation transmitted over one circuit into the other.

The Condict Controller Patent.—The Nassau Electric Co. Enjoined.

Judge Lacombe, of the United States Circuit Court for the Southern District of New York, last week issued preliminary injunctions on the Condict patent controlled by the General Electric Company, against the Nassau Electric Railroad, of Brooklyn, enjoining the further use of the electric car controllers, which were made by the Steel Motor Company, and against the Walker Company, enjoining its manufacture of the several types of series parallel car controllers made by it.

The operation of this injunction is suspended until the next session of the Court of Appeals to give the defendants an opportunity for appeal. This is the same patent recently sustained at final hearing by Judge Townsend.

Digitized by Google

OBITUARY

Death by Accident of Dr. John Hopkinson.

As we go to press a cable dispatch announces the death of Dr. John Hopkinson, the celebrated English electrical engineer, and his son and two daughters, who were killed while ascending the Dents de Veisivi, in the Canton of Valais, the mountains of which are among the highest in Europe, and which are exposed to furious torrents and destructive avalanches. The party had gone on their perilous trip without the assistance of a guide. Dr. Hopkinson had intended starting for New York on September 28, the trip to be made in connection with a syndicate which he was forming for the purpose of developing some of his inventions.

CATALOGUES.

Frank H. Stewart & Co.

A very complete and interesting catalogue of electric bells, electric gas lighting, telegraph and speaking tube supplies has just been issued by F. H. Stewart & Co., 35 North Seventh street, Philadelphia, Pa. It measures 9x12 inches, is handsomely bound and contains a complete index of a large number of electrical goods, such as batteries, annunciators, bells, push-buttons, gas lighters, telephone and telegraph supplies, motors, wire, insulators and battery gauges. The catalogue will be sent to any one on application.

A Quarter of a Million Horse Power.

This is the title of a very handsome and instructive booklet issued by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. It contains a mine of information on electrical transmission by polyphase currents. It is indisputable evidence of the company's ability to transmit electrical power to any extent over any desired distance. Only a few of the best known plants installed by this company are enumerated, although the list comprises 185 plants in twenty-nine States and eight foreign countries. The distance over which the current is transmitted ranges from one to seventy-eight miles. Among the plants described and illustrated are the Niagara Falls Power Plant, the Helena Water and Electric Power Company's plant, the Niagara plant of the Canadian Niagara Power Company, the Dolgeville (N. Y.) plant and the Apple River Power Company's plant at New Richmond, Wis. There are also shown beautiful illustrations of the motors installed in Buffalo and intermediate points between there and Niagara and the installation in the Cumberland Paper Mills in Maine, nearly all of which have been illustrated in our columns. The remaining stations are simply enumerated, the size of generators, motors and transformers, the transmission voltage and the nature of the service being given. The book is beautifully printed, has a handsome cover and does great credit to the company. It will be sent to any one on application.

The Development of the Telephone.

This is the name of a very ingenius and instructive pamphlet sent to his customers and interested parties by Mr. E. C. Bickel, the general manager of the Elkhart Telephone Company, Elkhart, Ind., an independent exchange. The story is told of how the company was started, how the switchboard grew year by year, what the people have gained by the service, and what prospects there are for the future. The pictures on the left-hand pages tell a story by themselves. The first is a single panel board having a capacity of 100 subscribers, which was installed on December 1, 1895. The second picture shows a switchboard with 200 subscribers capacity, installed January, 1896. In June, 1896, an additional panel was added, making the capacity 300 subscribers. The fourth picture shows a board with 350 subscribers, as it appeared in January, 1897, and the last picture shows the switchboard as it is to-day, with 500 subscribers capacity and four operators, against one which appeared in the first picture. It is a pretty story without words and one which speaks volumes. Mr. Bickel also announces that as the initial expense of this little publication was rather out of proportion to local benefits, he is prepared to sell additional copies to other exchanges who are in their formative period for ten cents a copy.

THE STOCK MARKET

An Advance All Along the Line.

Last week's stock market reflected admirably the sentiment of the business community, which is again reassured of the stable conditions of trade consequent upon the approaching signing of the treaty of peace. The number of shares dealt in on the stock exchanges shows vast weekly increases, indicating the eagerness of investors, while the prices obtained are tending steadily upwards.

Western Union sold around 95, with 18,315 shares dealt in. General Electric touched 41½, with 6,524 shares sold. New York Edison Illuminating sold at 133¾.

There was little change in the metal market. We quote the following market prices: Iron, Northern, No. 1 foundry, $11.25; Southern, No. 2 soft, $10.25; steel rails, $18.50; lake copper, ingot, $12.20; tin, $16.15; lead, $4.12½; spelter, $4.80.

TRADE NOTES AND NOVELTIES

The Montauk Multiphase Cable Before the Association of Fire and Police Telegraph Superintendents.

AT the third annual convention of the National Association of Fire and Police Telegraph Superintendents and Municipal Electricians, held at Elmira, N. Y., last month, the Committee on Exhibits made the following report on the Montauk multiphase cable:

"The undersigned, a committee appointed to report on the exhibit of the auxiliary fire alarm and the new cable of the Montauk Multiphase Cable Co., as adapted to the system of the Gamewell Fire Alarm Telegraph Co., beg leave to report as follows:

" 'We find properly located and connected up one fire alarm box, arranged so as to be operated from an auxiliary sub-station also the proper arrangements and connections for automatically sending in an alarm of fire by means of multiphase cable, a fusible wire being burned through or cross connected by contact with a slight blaze or fire such as a match might cause. On the application of a very slight fire from a match, the multiphase cable was cross connected, thus throwing on an additional current of electricity, the composite wire was melted, thus opening properly another line, relieving a light current which has previously been in operation.

" 'By these simple means, the main box was pulled, the alarm struck on a local gong attached to the circuit, a warning bell rang to indicate that the line was in operation, and the instantaneous sounding of its alarm showed that all claims as to the merits of the purpose and operations of the apparatus had been fulfilled. It is simple in action, and reliable as a fire alarm adjunct.

" 'The Montauk multiphase cable is practically a substitute for a thermostat, and this cable being run in out-of-the-way places, or in dangerous localities in buildings where fire is liable to occur, really makes a continuous thermostat, ready at all times for action in case of fire or dangerous heat at any point where the cable runs."

The report was signed by the committee consisting of the following well-known gentlemen: Wm. Brophy, Inspector Wires, Boston, Mass.; M. W. Mead, Sup't Bureau of Electricity, Pittsburg, Pa.; Geo. F. MacDonald, Sup't Fire Alarm, Ottawa,

Digitized by Google

Canada; F. C. Mason, Sup't Police Telegraph, Brooklyn, N. Y.; W. N. Thompson, Sup't Fire Telegraph, Richmond, Va.

The gentlemen constituting this committee being all professional experts of national reputation, renders any action taken on their part of value and interest to the profession at large. The report denotes their approval of an important progressive step in fire alarm protection.

The Largest Arc Dynamo.

There is now nearing completion at the Rushmore Dynamo Works, Jersey City, what will be the largest arc machine ever constructed. It will operate on the new multi-circuit system lately perfected by Mr. S. W. Rushmore, and at 500 r. p. m. will supply two independent circuits of 150 ten ampere arc lamps each, or a total of 300 lights. This is claimed to be just double the size of the largest arc machine now in service.

The machine has four poles and resembles an ordinary constant potential generator. Unlike other so-called multi-circuit machines, the circuits are all in parallel and cannot be connected in series. Each circuit has a separate pair of brushes and regulation is effected by a simple solenoid acting on each brush rocker. There is no sparking, and either circuit may be open circuited or short circuited, with any load, without any effect upon the other circuit.

Mr. Rushmore is now designing a larger machine for direct connection to the Willans engine. These new machines will be put in under the fullest guarantee and it is expected that the efficiency will be nearly as high as in the latest type constant potential machines of the same kilowatt capacity.

Second Annual Outing of the Employees of the Conduit Wiring Co., Davis & Brussel, Successors.

The second annual outing of the employees of the Conduit Wiring Co., Davis & Brussel, Successors, was held August 21, 1898, at Donnelly's Grove, College Point, L. I. A most enjoyable day was spent in bowling, land and water races, etc. Amongst the visitors were Messrs. Olson and Harrington, of the Habirshaw Co.; Mr. Scribner, of the Bryant Co.; Mr. Kirkland, of the Circular Loom Co.; in addition to representatives of most of the large supply houses in New York. Mr. Davis, of the firm, was also present, and took an active interest in the games and other diversions. Messrs. Fenton, Koehler and Bennett were the committee in charge of the affair.

The Cleveland Electric Trading Company, Cleveland, Ohio.

THE business of this company, as indicated by the name, is chiefly trading in electrical supplies. This includes the buying of second-hand electrical machinery and appliances, overhauling, refitting and selling the same. They also deal in new stock, being selling agents for some of the first-class dynamo and supply manufacturers. They are also contractors for installing and equipping lighting and power stations, including the steam and engine equipments as well as the electrical features.

Mr. W. H. Pelton, the manager, is both an electrical and steam engineer, and has had a long experience in this line of work, both for others and on his own account. A stock of generators and motors, including both new and second-hand goods, is kept constantly on hand. Besides repairs to their own purchases, the shops are equipped for repairing armatures of all descriptions, and repair work is made an important part of the business.

It is a mistake to suppose that second-hand electrical machinery is necessarily worn and defective. It is put on the market usually because it has been superseded by heavier and later-date machinery in order to meet the exigencies of the larger demand for light and power. When redesigned, as is done in many cases by this company, it is about as good as new, and is offered at such a price as to make it an object to prospective purchasers. The contracting department of the business is prepared to undertake the installation and equipment of stations of any character, and guarantee all their work to be as good as the best. In short, the company is prepared to meet any demand along any of the above lines that may be made and is ready to buy second-hand material to an unlimited amount.

The offices of the company are at 806 Cuyahoga Building.

WESTERN NOTES

JULIUS ANDRAE & SONS' COMPANY, of Milwaukee, have secured the agency for the famous Ericsson telephones in the Badger State. These telephones are all that is claimed for them and are proving themselves beyond a doubt the standard of the world. They are experiencing a healthy run on "O. K." batteries.

MR. JAMES HEALEY, who recently returned to Milwaukee from a trip through Northern Illinois in the interest of the Julius Andrae & Sons' Company, states that the business conditions in the rural districts are very favorable. The splendid crops of the season have made it possible for the farmers to put in telephones and necessities in the electrical line.

COOL. Almost entire Milwaukee is kept cool by breezes furnished by Lundell fan motors. Julius Andrae & Sons' Company, who are the Milwaukee selling agents, have succeeded in placing the Sprague goods in many of the largest local business houses, hotels and theatres, including the Alhambra Theatre, Palm Garden and Kroeger Bros.' large clothing establishment.

THE NATIONAL ELECTRIC COMPANY, located at 15 Michigan street, Cleveland, O., are reporting large electrical repair orders received during the last few months. They are at present rebuilding a number of large generators and are manufacturing small motors and experimental machines. A detailed description of the business of this company appeared in our issue of August 11, 1898.

WALKER COMPANY will exhibit at the Street Railway Convention, Boston, the following apparatus: Section of Walker underground conduit system, with car in operation, 15-L railway motor in operation, 15-L motor, open to show construction, No. 33 S. motor, mounted; No. 33 S. motor, open; set of 33 S. armatures, in various stages of construction; set of 33 S. motor parts; standard trolley, standard railway switchboard panels, with wattmeter, S. controllers in operation, solenoid partitions open and in operation.

MR. F. E. DRAKE, of the Walker Company, has been selected as electrical adviser to Commissioner General Ferdinand Peck of the United States to the Paris Exposition of 1900. Mr. Drake will sail for France with the Commissioner General and party on the steamer "La Touraine" from New York on September 3. He expects to return to this country about the middle of October, and will then resume his duties with the Walker Company.

MASON & RICHARDS CO., 314 Security Building, St. Louis, Mo., have issued a broadsheet notice to the trade relative to the agencies now in their hands, including Walker apparatus, Keystone Electric Co.'s machines, Keystone instruments, Partridge carbons, and a large number of other specialties.

BOONE, IA. The Boone County Telephone Co. has a capital stock of $13,300 paid up. J. L. Stevens is president, and C. E. Deering secretary. The apparatus was supplied by the Western Telephone Construction Co., and a Sterling Electric Co. switchboard is now being added. There are 340 subscribers and 125 miles of toll line. The present board has a capacity of 400 drops. Rates are $2.50 per month, business, and $1 for residences.

NEW YORK NOTES

ROCHESTER, N. Y. The Standard Electric Construction Company has been dissolved by E. H. Freeman and W. H. Tobey, but the business will be continued under the same name and style by E. H. Freeman and B. A. Vandy.

F. CROSELMIRE, Newark, N. J., the well-known manufacturer of platinum, has left for the Ural Mountains, Russia, to be away for several months. Mr. Croselmire goes to make contracts for and buy the crude platinum, which he refines at his extensive works in Newark.

Digitized by Google

A COMPLETE X-RAY OUTFIT, presented by the General Electric Company to the United States Government at the beginning of the war with Spain, is reported to have been the only apparatus which had worked satisfactorily on the hospital ship Relief. in Cuban waters.

NEW YORK CITY. It is rumored and denied that the Metropolitan Street Railway Co. is to engage in electric lighting.

ADVERTISERS' HINTS

WILLIAM E. QUIMBY, 86 Liberty street, New York, advertises screw electric pumps, instead of screw steam pumps, as was erroneously stated in a recent issue.

JNO. R. ROEBLING'S SONS CO., Trenton, N. J., recommend the use of bi-metallic wire for overhead lines, stating that it possesses those qualities essential to good working, and the question of cost also appeals to the user.

THE AMERICAN ENGINE CO., 32 Raritan avenue, Bound Brook, N. J., call attention to the excellence of their direct-connected generating sets, and also to their belted generators and detached engines. Their latest production is a slow speed direct connected motor for driving large printing presses and other heavy machinery.

BIBBER-WHITE CO., 49 Federal street, Boston, Mass., say the name "American" was selected for their new "Welsbach gas-lighter" because "it has the good points of all others and no weaknesses." They also say that a trial order makes a regular customer.

THE NOWOTNY ELECTRIC CO., 212 Lawrence street, Cincinnati, O., publish an up-to-date list of the agents for their long-burning enclosed arc lamps possessing many advantages particularly their own.

PINS AND BRACKETS are advertised by the Electric Appliance Co., 242 Madison street, Chicago, Ill. All their pins and brackets are made either from the best split live oak or selected locust and are warranted sound and strong.

JULIUS ANDRAE & SONS CO., Milwaukee, Wis., say their telephones never disappoint. Their catalogue No. 10 is now ready for distribution.

THE GENERAL INCANDESCENT ARC LIGHT CO., 572 First avenue, New York, offer direct current enclosed arc lamps for several classes of service, and also alternating current lamps. They have some new circulars which may be obtained.

NEW ENGLAND NOTES

MONTVILLE, CONN. The estate of C. M. Robertson, recently lost by fire their boiler house. In order to obviate, if possible, a like experience in the future they have decided to put up a thoroughly fireproof construction in its place. The building will have steel framework, brick side walls and an absolutely fireproof roof, consisting of corrugated iron covering laid on the Berlin Iron Bridge Company's patent anti-condensation roof lining. Steel trusses will support the roof. The building is about 50 feet square, divided by a corrugated iron partition through the centre, making a boiler room and pump room. The ventilation is obtained by monitors on the ridge of the roof, having sash on the sides. The Berlin Iron Bridge Company are furnishing and erecting the steel work.

SOUTHERN NOTES

MR. HENRY WIDMER, 522 Custom House street, New Orleans, La., notifies the public that he is in the electrical construction field. He has the local sole agency for C. & C. dynamos and motors.

BRISTOL, TENN. The Bristol Virginia Corporation have just completed an artesian well and are now open to receive bids on pumping power, with plant sufficient to run some 75 arc lights. Mr. C. W. Hannah will receive estimates on the power plant. Mr. H. J. Wilcox, Bristol, Tenn., would like to receive prices and estimates on lighting apparatus.

GEORGE A. CRAGIN, of Houston, Texas, representing Washburn & Moen Manufacturing Company, has brought out a very attractive advertising scheme calling attention to wires in general and "Crown" wires in particular. The advertising takes the form of an imitation of hand painting on porcelain of an attractive personality.

BALTIMORE COUNTY, MD. The county is now expending $2,404 a year on its fire alarm system. Mr. T. W. Offutt, general manager of the Mt. Washington Electric Light and Power Co., has offered to carry on the whole thing in good shape for $1,200 a year.

PHILADELPHIA NOTES

WASHINGTON, PA. The Washington Electric Light Co. are increasing their plant by the addition of a 200 h. p. Ball engine, built by the Ball Engine Co., Erie, Pa.

FOREIGN NOTES

GERMAN ELECTRICAL UNITS. The bill for the legislation of the ohm, volt and ampere in Germany has now passed through all its stages in the Reichstag. It has been amended to the extent of an "e" added to the word "amper," originally proposed.

CONTENTS.

EDITORIALS:
Novel and Extending Uses of the Storage Battery 202
The Limitation of Power Transmission 202
Municipal Ownership Agitation and Its Antidote..... 203
The New Element—Etherion 203
Single-Phase and Multiphase Motors on Lighting Circuits..... 203

POWER TRANSMISSION:
The Mechanicville, N. Y., Three-Phase Transmission Plant (illustr.) 193
Long Distance Transmission of Power .....Ernst J. Berg. 199

TELEPHONY AND TELEGRAPHY:
Aerial Construction of Fire and Police Telegraph Lines..... William H. Thompson. 200
Telegraph Revenue Tax Fight in Kansas 200

EDUCATIONAL:
Electricity in Engineering Courses Other Than Electrical..... J. P. Jackson. 200

ELECTRIC LIGHTING:
Electric Lighting at the Pitman Grove Camp Meeting (illustr.)... Bingham Wood. 201

ELECTRIC TRANSPORTATION:
The Cabs and Central Station of the Electric Vehicle Co., of New York (illustr.) 204

SOCIETY AND CLUB NOTES:
Boston Meeting of the American Street Railway Association..... 211
The Fiftieth Anniversary Meeting of the American Association for the Advancement of Science 212

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Aug. 16, 1898. 213

LEGAL NOTES:
The Condict Controller Patent: The Nassau Electric Railway Co. Enjoined 213

OBITUARY:
Death by Accident of Dr. John Hopkinson 214

CATALOGUES:
Frank H. Stewart & Co.—A Quarter of a Million Horse Power.—The Development of the Telephone 214

THE STOCK MARKET:
An Advance All Along the Line 214

TRADE NOTES AND NOVELTIES:
The Montauk Multiphase Cable Before the Association of Fire and Police Telegraph Superintendents 214
The Largest Arc Dynamo.—Second Annual Outing of the Employés of the Conduit Wiring Co., Davis & Brussel, Successors.—The Cleveland Electric Trading Co., Cleveland, O.—Western Notes.—New York Notes 215
Advertisers' Hints.—New England Notes.—Southern Notes..... 216

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. SEPTEMBER 8, 1898. No. 540.

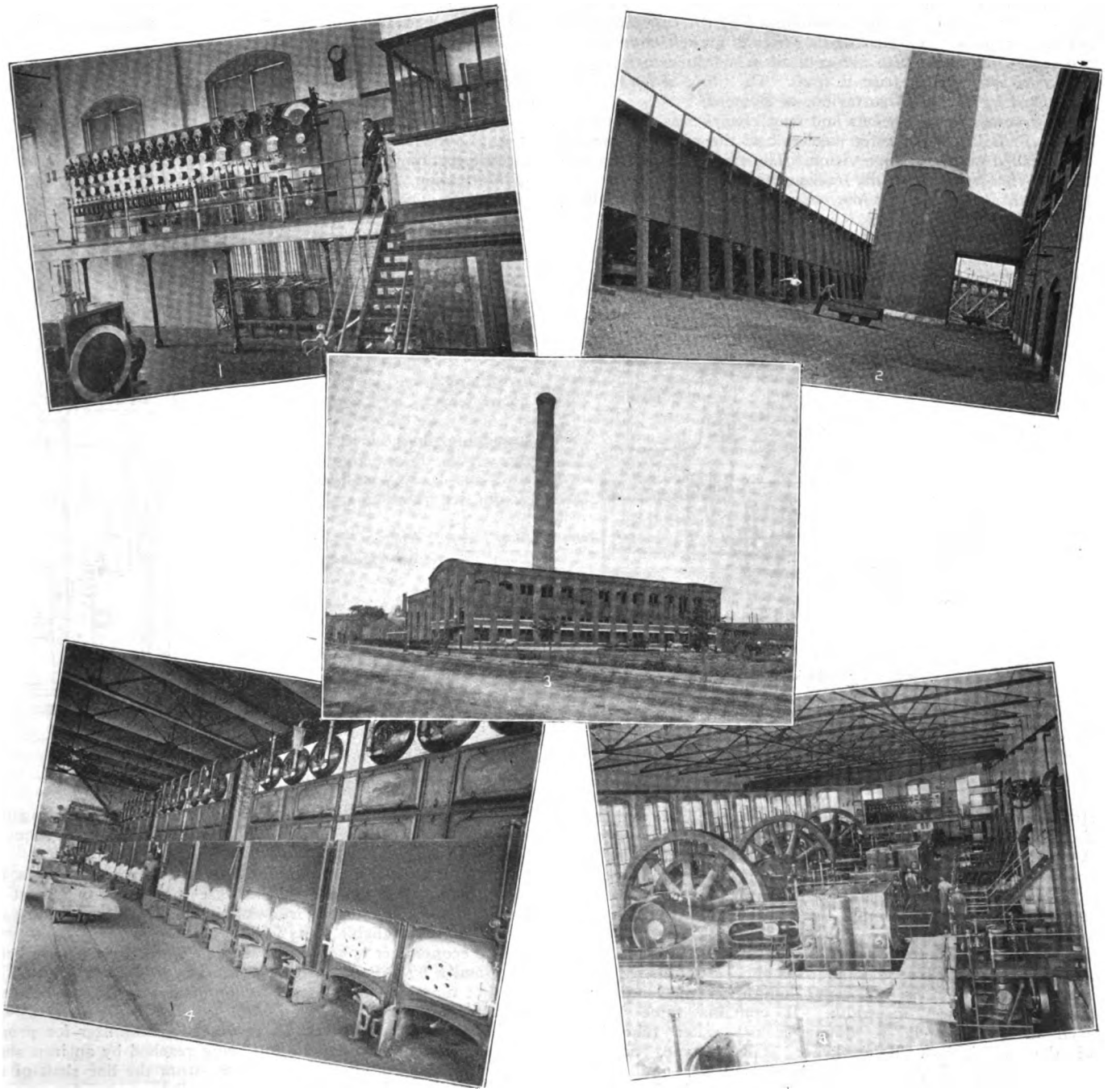
THE HARVARD POWER STATION OF THE BOSTON ELEVATED RAILWAY COMPANY.

BY H. W. WELLER, C. E., E. E.

INTRODUCTION.

THE steady growth of travel over the lines of the Boston Elevated Railway Company, formerly the West End Street Railway Company, has necessitated the construction of another large power station.

Owing to the marshy nature of the ground and the heavy character of the machinery to be installed close piling had to be driven to a depth of 35 feet under all foundations. The tops of the piles were cut off at a fixed level and a heavy bed of cement concrete laid to carry the foundations, which, of necessity, had



Switchboard Gallery. View of Power Station. Coal Pockets and Chimney.

Boiler Room. Engine and Dynamo Room.

HARVARD POWER STATION, BOSTON ELEVATED RAILWAY CO., BOSTON, MASS.

This is located on the east side of Boylston street, in Cambridge, close to the Charles River and a short distance from Harvard Square.

to be very heavy and substantial, those for the chimney being of granite masonry.

The building fronts towards the Charles River, terminating

Digitized by Google

on Boylston street. It is 171 feet 8 inches long and is planned for a subsequent extension of 71 feet additional. The building is 125 feet 8 inches wide.

In a general way the buildings conform to the plan of the Dorchester Power Station, which was described in The Engineer of March 24, 1897, but are much larger. The engine room is in front and the boiler room adjoining it in the rear, with the coal-handling machinery and the stack behind the boiler room.

The buildings are of best selected hard-burned red brick, with granite water tables, cornices, sills and trimmings, and are built on concrete and stone foundations. The floor of the boiler room is about one foot above the level of the street and on a level with the basement floor of the engine room, and the floor of the engine room proper is about 12 feet above that of the basement.

The roof of the engine room is carried on arched steel trusses, supplied and erected by the Boston Bridge Company, and is of the special fire-proof construction adopted by the engineer of the railway company. It consists of a series of arches, composed of two layers of special flat fireproof tiles laid in cement, which arches are sprung from truss to truss. The tiling of the roof was cnstructed by Messrs. Guastavino, of Boston.

The system of coal pockets and trestle work was designed by Mr. C. F. Baker, the master mechanic of the railway company, and installed under his supervision. The coal is brought in cars, hauled by electricity over the tracks of the railway company from their main coal storage at the central power station at Albany street, and, being taken up the special inclined trestle and around the loop, is dumped into the bins in the rear of the boiler room. A track is laid underneath the bins or hoppers, and the boiler room charging cars of the C. W. Hunt make are run under the hoppers, filled by gravity, and are then run over the tracks right in front of the furnace doors. The coal is not shoveled from the time it is brought in ships alongside the dock at Albany street until it is shoveled from the cars into the furnaces. The storage capacity of the bins at Harvard is about 750 tons.

The boiler room is the same length as the engine room and about 56 feet in width. It contains three batteries, each of two 500 h. p. double-decked water tube boilers of the well-known Babcock & Wilcox type, making a total capacity of 3,000 h. p. at this time, and space is left for another similar battery, making a total of 4,000 h. p., which can be accommodated in the present building. The extension as laid out on the plans will admit of two more batteries, each of the same capacity, in the future. The roof is carried on straight steel trusses and has a monitor over the economizer. As shown in the plan, each boiler has three water drums, which are of open hearth steel 42 inches in diameter and 22 feet long, projecting through the front of the setting. Each drum is protected by a 4-inch Ashton pop safety valve, set to blow at a pressure of 175 pounds to the square inch.

The face of the setting in the front of the boilers is composed of white enameled glazed brick, making a very neat finish.

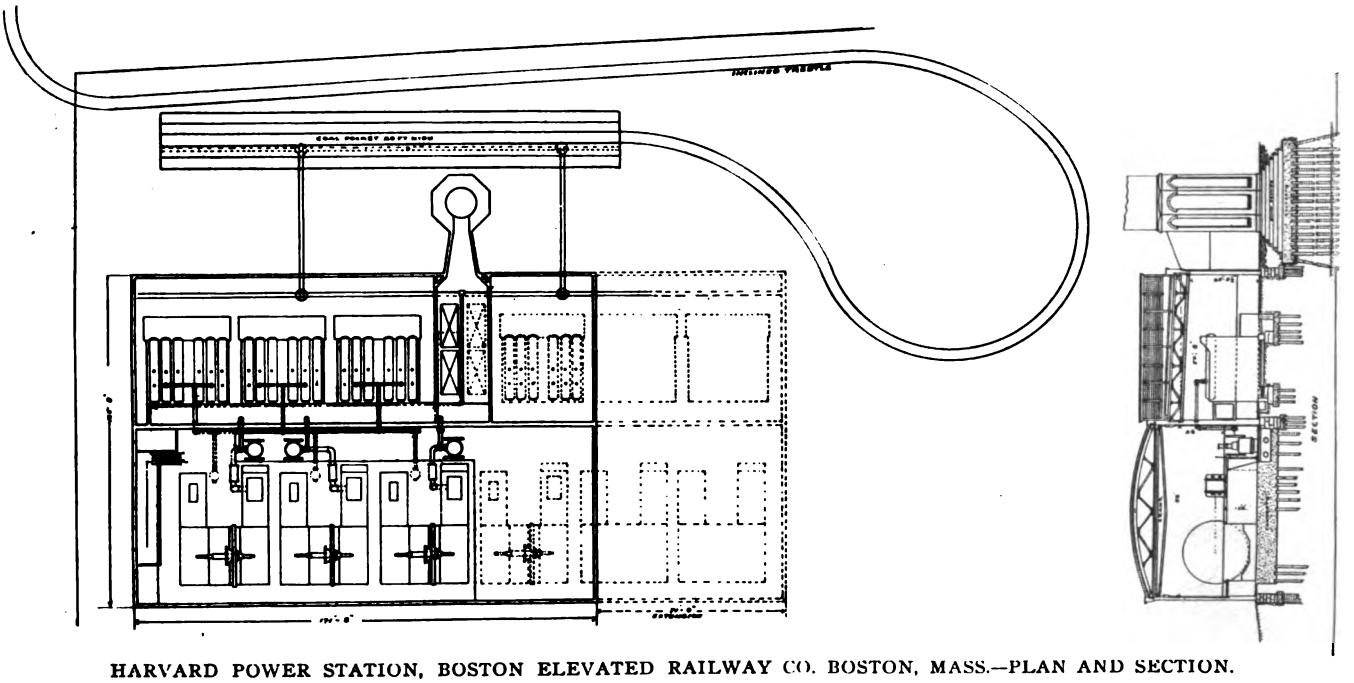
The boilers are provided with extension furnaces, which project about 8 feet from the fronts of the boilers, and are built of selected hard-burned brick, with a heavy lining of best fire-brick. The use of this extension is to give a larger combustion chamber and to prevent as much of the smoke as possible and utilize it for making steam.

The ashes are at present removed by hand and used for improving the adjoining property of the railway company.

All the feed piping and connections are of extra heavy brass, the water columns being of the reliance pattern fitted with high and low-water alarms. The feed water is admitted into the front of each drum, with the necessary stop and check valves. The blow-off piping is carried in a trench, covered with cast-iron floor plates, in the rear of the boilers.

Large doorways are provided in the boiler room wall opposite the boilers. The doors for these are hung vertically for convenience and are properly balanced with counter-weights.

The smoke flue from each boiler is connected into the main flue, as shown on the plan, and the gases are carried through a Greene economizer, furnished by the Fuel Economizer Company, of Matteawan, New York. The economizer consists of 56 sections, each containing 10 tubes, and aggregating 6,720 square feet of heating surface. Provision has been made for duplicating this machine with the increase of boilers which will be required in the future.



HARVARD POWER STATION, BOSTON ELEVATED RAILWAY CO. BOSTON, MASS.—PLAN AND SECTION.

One possible objection to the use of the economizer is the floor space taken up, but in this case the objection is met by carrying the apparatus on iron columns and girders, leaving the ground space available to its fullest extent.

The economizer is connected with the stack by a square brick flue, and a by-pass flue with the necessary dampers is provided so that the economizer can be cut out at any time it becomes necessary.

Sufficient room is arranged above the economizer for proper inspection and cleaning, the top being reached by an iron stairway. The tube scrapers are operated from the line shaft of the power pumps, which are driven electrically.

Each boiler is provided with an individual damper in the setting, and the draft is also automatically controlled by a main damper, set vertically in the side of the stack and operated by a Locke damper regulator. An indicator in the boiler room continuously shows the position of this damper for the guidance of the men. The boiler room floor is of concrete, which presents a smooth and durable surface.

Digitized by Google

STEAM AUXILIARIES AND STACK.

The stack is 226 feet high and is built of selected hard-burned brick, with a 10-inch fire-brick lining extending for a height of about 50 feet.

The stack is octagonal in shape for about 40 feet, with molded corner brick and a granite plinth about 12 inches thick. The rest of the stack is circular, the outside diameter tapering from about 20 feet at the bottom to about 16 feet at the top, and finished off with a cornice and capped with a cast-iron cap made in segments and properly fitted and clamped together. The inside diameter is 11 feet. Two lightning rods of copper extend from the bottom to the top of the stack on opposite sides. These are connected underground to copper cylinders and at the top to a copper ring placed around the cap and carried on insulators. To this ring are connected four copper rods, tipped with platinum and extending to a height of 6 feet above the cap, thus forming a most efficient protection from the dangers of lightning.

The engine room is 170 feet in length by 66 feet in width, inside dimensions. It is built of selected hard-burned red brick, with granite sills and trimmings. It has 24 large sash windows on three sides and is therefore well lighted and airy. Large double doors are provided at each end of the room.

The basement floor is of concrete and level with that of the boiler room and has the necessary communicating doors with the latter. The pumps, condensers and heaters are placed in the basement. Iron stairways lead from the basement to the engine room at either end and also in the middle.

The feed pumps consist of three vertical triplex power pumps, 6-inch diameter by 8-inch stroke, driven by belts and shafting from a 500-volt electric motor. There is also one duplex steam pump 14-inch and 8½-inch by 10-inch stroke. This was supplied by the Deane Steam Pump Company, of Holyoke, Mass. The power pumps, being operated electrically, can be used to feed the boilers when steam is not available.

The engine room floor is laid with 4-inch spruce planking on iron girders and finished off with hard maple in narrow strips, and carefully polished and oiled.

Openings are left in the floor to permit of the pumps and condensers being seen at all times by the engineers on watch, and these openings are properly guarded by railings. Cast-iron floor plates are provided for easy access to the machinery and piping where necessary.

The engines and all steam and exhaust piping are covered with magnesia composition supplied by Messrs. Nightingale & Childs, of Boston.

THE ENGINES.

There are three engines, each of 1,800 h. p., nominal, with space in the present building for one more, while the proposed extension will have room for two additional, as shown by dotted lines on the plan, making six engines of a total nominal horse power of 10,800 as the ultimate capacity of the station.

The engines are all similar, horizontal, cross-compound, condensing, of the Corliss type, and are direct connected to the generators. The cylinders are 28-inch and 56-inch in diameter and 60-inch stroke, and the engines operate at a speed of 80 revolutions per minute. The flywheels are 24 feet in diameter and are built up in segments, rigidly bolted together, and are very massive, each weighing upwards of 60 tons.

The valve gear is an improved Reynolds-Corliss, the valves being placed in the cylinder heads to bring them closer together.

There is a reheater receiver between each of the high and low-pressure cylinders, and the piping, which is placed below the engine room floor, is arranged so that either cylinder may be run alone or run condensing or non-condensing.

The foundations for the engines are laid up in hard-burned brick in cement. The steam piping is specially designed and constructed for high-pressure work. It is extra heavy wrought-iron pipe and has cast steel fittings. The flanges are faced and grooved and corrugated copper gaskets are used in making the joints. The piping was furnished and erected by the engineers of the railway company. The main steam pipe is 14 inches in diameter and the connections from each boiler are 8-inch. All the valves are of the Walworth & Chapman flanged pattern for heavy duty, with outside screw and yoke, and each valve has a by-pass. All the main valves are controlled from the engine room floor.

A Reynolds separator is installed between the main steam pipe and each engine to remove the entrained water from the steam.

The feed piping is covered with magneso asbestos sectional covering, supplied by the H. W. Johns Company, of Boston and New York, and is neatly finished off with polished brass bands. The condensers are of the vertical independent jet type, Reynolds pattern.

The exhaust piping is 20 inches in diameter and is provided with an automatic relief and stop valve of the Reynolds patent to permit of a free exhaust into the atmosphere in case of any interruption in the operation of the condensing apparatus.

The oiling system is a combination of pressure and gravity and is very efficient. The engines were built and installed by the E. P. Allis Company, of Milwaukee, Wis.

There is a traveling crane of seven-ton capacity, supplied and installed by the Boston Bridge Company. It runs on girder tracks built into the side walls of the building.

THE GENERATORS.

There are three direct connected 12-pole compound-wound generators, each of 1,200 kilowatts capacity, with cast steel frames and pole pieces. They were manufactured and installed by the General Electric Company. Each field spool is arranged with separate spaces for the shunt and series windings. The series coils are wound with flat strips of copper, while the shunt coils are composed of the usual round insulated copper wire.

Series bars are attached on one end to the series windings on the two lower spools, and on the other to slate blocks screwed to the frame of the generator.

An adjustable shunt is placed across one end of the terminals for regulating the compounding of the machines. This shunt is very long, and is held in place by a stand with insulated supports for the shunt to rest on. The brush leads consist of a number of lengths of flexible insulated cable, which are brought to slate blocks attached to the frame. Insulated copper rings are used for connecting the positive and negative brushes, respectively, together. An adjustable brush holder yoke allows all the regulation of the brushes that is necessary.

The armatures are built up of laminated disks of soft iron dovetailed into the spider and held in place by large cast-iron rings bolted securely together. Slots are cut in the discs, in which the winding is placed. This consists of the well-known barrel type, with four bars of flat insulated copper laid in each slot and soldered together on the flywheel side, the change and connections being made on the front, where flexible leads connect the windings to the commutator. Wire bands on the core and adjustable copper bands on the ends hold the windings in place.

Each frame rests on two foundation plates, and these in turn are bolted down on the capstones. On each end of the plates a shoulder is cast to prevent possible movement of the machine in case of trouble.

The frames are insulated from the foundation plates by maple blocks.

Three 1,000,000 c. m. cables connect the positive side of the generators to the switchboard, and the same on the negative side. Kicking coils are placed in the positive cables and the positive leads on all generators are the same length to ensure perfect regulation. Suitable equalizing switches are placed near the generator.

THE SWITCHBOARD.

This is placed on a raised gallery on the west side of the engine room, where all the machines are in sight. It is composed of thirteen feeder panels, three generator panels and one station panel.

Each feeder panel carries two feeders and has the necessary ammeters, switches and circuit breakers.

Each generator panel has a 5,000-ampere circuit breaker and ammeter, a 3,000-ampere double-pole switch and the field rheostat controller.

The station panel has on it a spare rheostat, which, in case of trouble, can be quickly connected. It also contains a 10,000 ampere total ammeter, lighting switches, the necessary station voltmeter and also a duplicate for use in case of accident to the other. The panels are of the standard General Electric make and the volt and ammeters are of the Weston type. A recording wattmeter of the General Electric make is also provided.

On the board is an automatic alarm, which, when a circuit breaker trips, rings a bell, which can be heard all over the station. Another and very novel feature designed by Mr. C. F. Baker, the master mechanic, is an arrangement to relieve the other generators of an excessive load should one unit be cut out of service quickly from any cause. Attached to each generator circuit breaker is a plug, which, when the breaker is tripped,

Digitized by Google

makes contact with one terminal of a small storage battery, the other terminal being connected to magnets directly under the armatures of the feeder circuit breakers. These magnets are strong enough to open each feeder breaker. The number of feeder breakers tripped is controlled by using a plug board with enough plugs inserted to trip enough circuit breakers to equal the load of the generator shut down. There is also a bus-bar in the rear of the switchboard, to which, by the use of a jumper, any circuit breaker can be opened and the load thrown to some other feeder board. Every precaution has been taken to prevent the shutting down of the station. A Bristol recording voltmeter and Crosby recording steam gauge are installed in the office, keeping an accurate record of the voltage and steam pressure for reference.

At one side of the switchboard gallery is the office of the chief engineer, below which are the various bath and toilet rooms for the use of the men.

The station is in charge of Mr. T. W. Teale, chief engineer, assisted by A. A. Warner, A. O. Fletcher, T. H. Kimball, G. W. Berwick, J. B. Libby, J. Thompson and A. E. Smith. Mr. M. Davis keeps the boilers in condition, with J. McCarthy, C. H. Breadmore, J. Tutts, J. Wright, J. M. Burley and H. K. Webber as firemen.

In conclusion, the writer desires to thank the various officials of the company for their courtesy and assistance, especially Mr. C. F. Baker, the master mechanic, under whose charge the station and its machinery were designed and erected.

Herrick's Electric Car Inspection System.

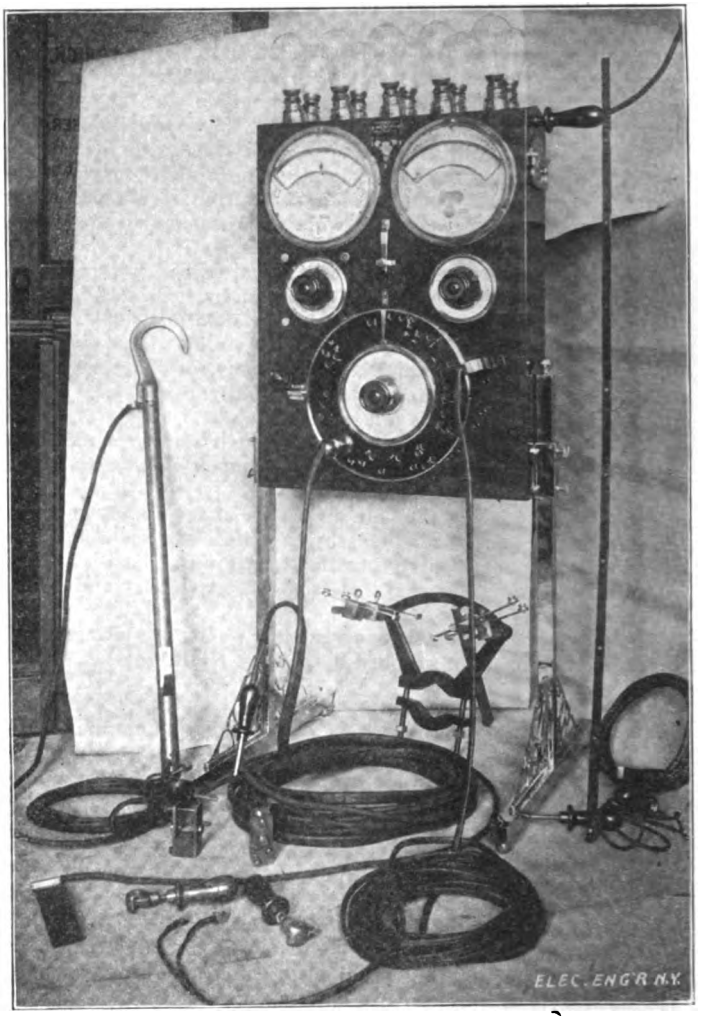
BY A. B. HERRICK.

THE mechanical maintenance of street railway equipment is amenable to visual inspection. The causes for mechanical depreciation are strains, friction and vibrations, ad the remedies for them can be easily applied, but the electrical part of an equipment depreciates from other causes, such as heating, from overloading the motors, lack of equalization between motors, the improper use of the controller by the motorman, and many other causes, but the effects are not necessarily visible and they are ordinarily only remedied after a breakdown has occurred. The inventor of this system, after examining into the cost of electrical repairs in a number of car barns, found that a large part was chargeable to the time taken to locate them, and often in dismantling the equipment to find them, and the repair was made on the broken-down part, whereas the primary cause of the breakdown had not been remedied.

As it is of more interest to cite examples than general principles, in one case where this testing system was applied an armature winder had been discharged, who, from samples of his work, was certainly an excellent winder and insulator. As soon as the test was applied to the equipments burnt out fields were found, and in 46 equipments 35 burnt out fields were discovered and replaced with good fields. Since that time there has been no trouble with armatures. Another case could be cited where the trouble being in the rheostat, the power consumption had crept up .4 of a kilowatt per car mile. Here the rheostat on the equipment had increased in resistance to such an extent that the car would not start until the third notch had been reached. During the passing to the third point the car was standing across the line consuming energy with useless results. Putting in proper rheostats showed marked increase in efficiency in the kilowatts taken per mile operated.

The electrical repairs are one of the uncertain features in car barn expenses, and the breakdowns and crippling occur when the equipments have been forced by extra service and their continuous operation would be of the greatest value. Again, it is well known that certain equipments are continuallly in trouble, while others operate continuously at little or no expense, and it seems to be an element of luck or chance whether an equipment can be operated continuously or not from an electrical standpoint, and yet all these equipments are uniformly equipped and should operate equally well. Still there is some reason why certain equipments in the same class do not give equally satisfactory service, and it is for the purpose of maintaining to a standard and making equipments uniform in their service that the "Herrick Electrical Inspection System" has been devised in order that these electrical inequalities can be made visual and be repaired. The cost of these electrical repairs as now carried out is abnormal and out of proportion to the revenue obtained from the operation of the equipment, and to bring out this cost clearer, in two cases which I have investigated the cost of electrical repairs of the equipment per car mile was in excess of the repairs per car mile of a 100-ton freight locomotive on the Pennsylvania Railroad.

It has been proved that by changing the car barn to a maintenance shop where the equipments can be brought up to a uniform standard electrically and kept there, rather than a place in which the cripples are repaired, decreases the cost of maintenance per mile and largely increases the reliability of service rendered. The Herrick testing system is devised as a method of locating any of the equipment troubles before they develop into breakdowns and render the equipment inoperative. The reliability of the system is such that in several shops where this system is used the inspector will write out the order for the electrical repair of the car without having seen it.



THE HERRICK ELECTRIC RAILWAY TESTING SET.

The system has been carried farther than the inspection of the equipment only. The set can be used in the winding room for locating faults in armatures, fields and rheostats, and also controllers and commutators, all necessary appliances and terminals being furnished by which these tests can be quickly and readily made, and all new work and repair work can be tested to see that it has been properly done and is up to standard.

This testing set can be put on the equipment and run out on the road, and equalization tests, power consumption, line losses, ground return losses, bond losses, electrolysis tests can be made; in fact, the set comprehends within itself every test necessary in the railroad business, and the tests and methods selected for these various tests have been the outcome of years of practical experience.

It was found that when the complicated connections were left in the hands of the inspector false results were obtained by misconnections and the instruments were burned out. To reduce this method to the simplest system possible all these terminals

Digitized by Google

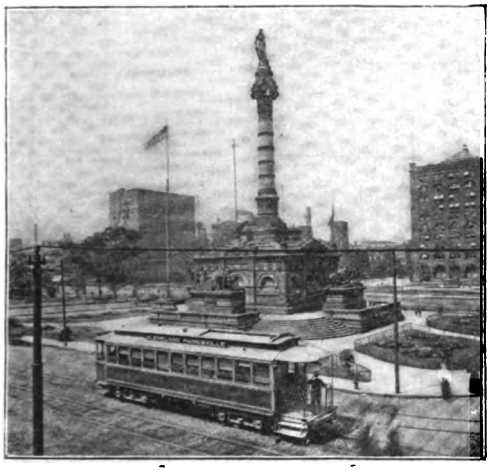
are brought behind a rotating interlocking dial and so laid out that only the proper receptacles are exposed for the terminals for that test when that test registers behind a pointer, and all the connections are permanently made inside the test case. This method avoids the possibility of misconnections and burn-outs and reduces the system to the simplest methods possible, so that anybody competent to make a mechanical inspection is capable after a short period of instruction of making and interpreting all the results.

Two special shielded Weston instruments are used, which are adjusted as milliampere and amperemeter for the main current. The other instrument is both a volt and ohmmeter and has four ranges of voltages for full scale and three ranges when reading ohms direct as an ohmmeter and one scale reading megohms insulation, besides the calibrated rheostats used in the inspector's tests. Every effort has been made so that the inspection test can be quickly made, and a complete inspection of an equipment need not take over three minutes where everything is provided for making these inspections.

THE CROSS-COUNTRY ROADS AT CLEVELAND, OHIO.—I.

BY C. B. FAIRCHILD.

INTRODUCTION.



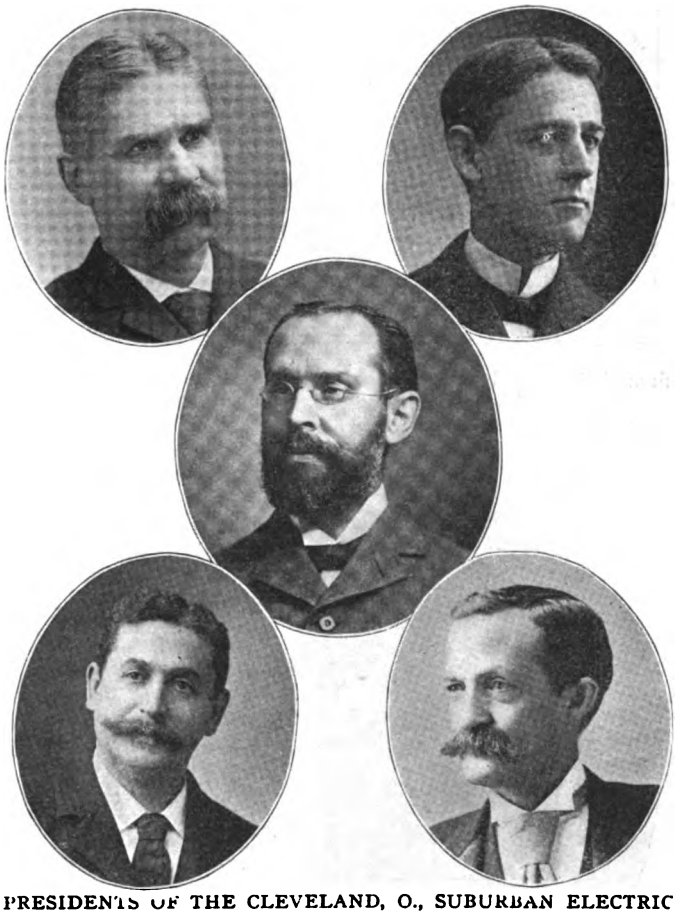
Soldiers' and Sailors' Monument, Cleveland.

The terms "suburban" and "interurban," as commonly used, are not names entirely applicable to five long electric high-speed railways that reach out in as many directions from Cleveland, and which are each outlined on the accompanying map. The lines, aggregating a combined distance of 156 miles outside the city limits of Cleveland, have linked the name of the city more prominently with this class of roads than that of any other city of the country. The term "suburban" carries the idea of an overgrown street railway, and "interurban" is a run of the same class of cars between two neighboring cities, but as these are not the conditions which are found in the roads which it is the province of this article to describe, the term used for the title of this story seems more appropriate.

This class of railways is distinct from all others; it is true, they have wheels and rails in common, but in function, equipment, speed and management there is a glaring contrast, and they require for their inception, construction and control an otherness of intellect from that found in ordinary street railway practice. They do not seem to be in their origin either inventions or discoveries, but rather creations, and that from an á priori source, for they were not founded on either observation or experience and did not seem to come in answer to a demand, but have grown up and have proved a financial success beyond the most sanguine expectation of the pioneers and promoters; indeed, they have produced new and independent results in the region of both material and social science. Now that they are here, and not mere problems, and their worth appreciated, both by patrons and investors, and because they are suited to a great range of conditions, people everywhere will want and accept them, so there is no question but they must multiply indefinitely, and if so, it will be of advantage for all to know their origin, condition, experience, standards and results, which have become positive and certain and will serve as a basis for those contemplating similar enterprises without having to repeat the experimental stages.

The general conditions as they exist in this locality are one large central city (Cleveland, having an estimated population of 375,000), surrounded by a rich farming country, with outlying villages and small cities within a distance of thirty-five or forty miles. It is claimed by those experienced in the construction and management of these lines that roads between cities of about the same size and character will not prove as successful as when there is one city sufficiently large to attract shopping by its business advantages and in turn supply a large pleasure traffic. Other conditions may vary widely, as they do in the case of the five lines herewith described, as each will be seen to have its peculiar characteristics.

The cars of all the cross-country lines enter the city over the tracks of one or the other of the two local companies, and the latter furnish the power, man and operate the cars, except in one case, collect the fares both ways inside the city limits, and pay to the former a royalty on a mileage basis for the use of the cars



PRESIDENTS OF THE CLEVELAND, O., SUBURBAN ELECTRIC RAILROADS.

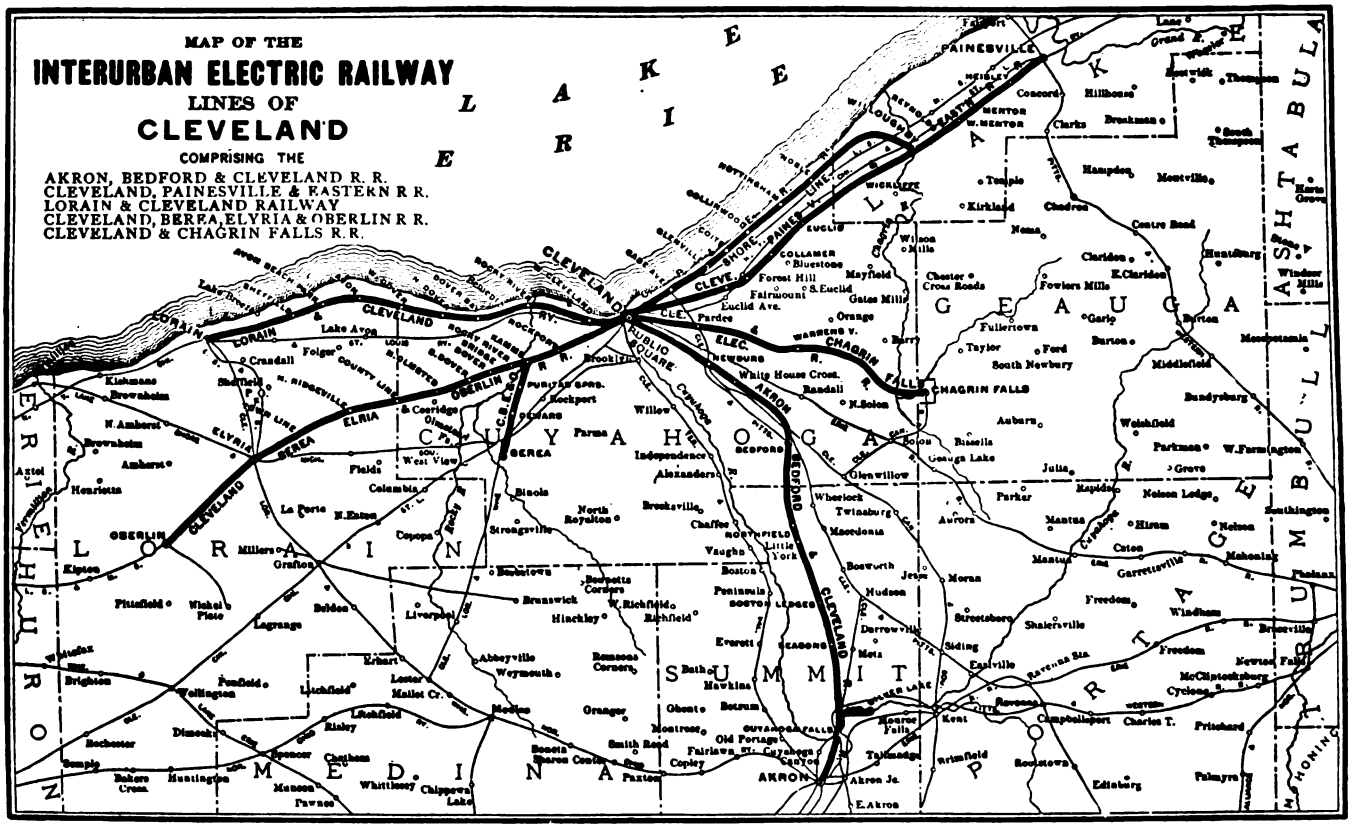
A. H. Pomeroy, Pres. Cleveland, Berea, Elyria & Oberlin R. R.
C. W. Wason, Pres. & Gen'l Mgr. Cleveland, Painesville & Eastern R. R.
H. S. Everett, Pres. Akron, Bedford & Cleveland R. R.
B. Mahler, Pres. Lorain & Cleveland R. R.
W. A. Taylor, Pres. Cleveland & Chagrin Falls R. R.

within the city limits. All the outlying lines operate long double-truck cars, which run single-ended and are vestibuled, and are usually divided into two compartments, one for the accommodation of smokers or for the reception of freight and express. All the cars make loops and pass the Square and Soldiers' Monument, in Cleveland, near the centre of the city, shown at the head of this article, and at the outer ends are turned on "Y's" or loops. Each of the companies, with one exception, provides its own agents for handling the freight and express; that of the other company is handled by the agents of the Amer-

Digitized by Google

ican Express Company, with the exception of the milk traffic.

Five companies control the six lines of road, and of these three are closely allied, being controlled by parties that are interested financially in each of the others. So here is the story as we find it to-day, the lines of each company being described in the order of their origin.

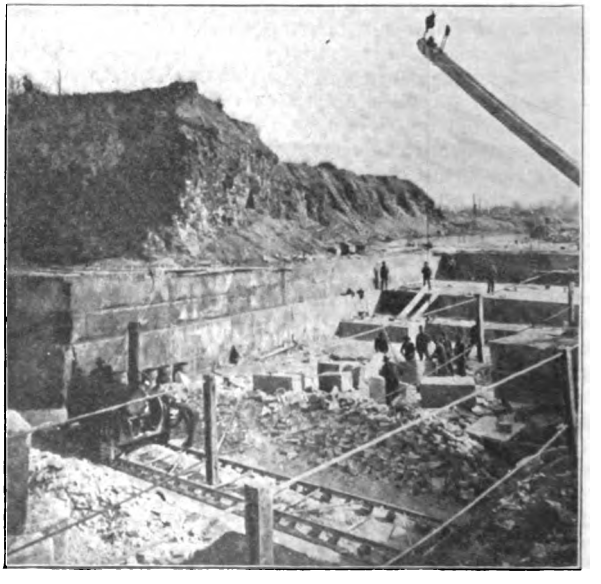


Cleveland, Berea, Elyria & Oberlin Ry. Co.

Tappan Walk, Campus, Oberlin College.

BEREA is a small city located about ten miles to the southwest from Cleveland, has a population of about 3,000, and here, in 1893, existed a small street railway, on which one one-horse bobtail car was operated between the hotels and depot. This line was owned by Mr. H. A. Pomeroy, cashier of the local bank, and a few associates, and during the year noted he and his associates were induced to lay a line of track along the highway to the city limits of Cleveland. What the motive power was to be does not seem to have been decided, but it was a question between dummy engines, storage batteries and overhead trolley. The financial depression of the same year called a halt in the operations, and the company were induced to exploit with the Ford & Washburn storage battery, and this company began the operation of a storage battery car between Cleveland and Berea during the winter of 1893 and 1894, and during the few months' run carried over 12,000 passengers, or enough to demonstrate that there was a paying patronage to be had over the line. This encouraged the owners, and, while they did not see fit to adopt the storage bttery system, they were induced to provide sufficient capital to put up the overhead equipment.

At this stage of development the Christy Brothers, of Akron, O., since prominently identified with a number of these roads, became interested in the enterprise and undertook to interest Cleveland capitalists in the scheme, but were turned down with more or less ridicule by the very persons now most largely interested in this class of roads. Nothing daunted, however, they returned to the Berea people, and enough capital was secured to equip the road with second-hand cars and motors and second-hand power station equipment. In May, 1894, the line was completed. A paying patronage at once developed, and capitalists began to discover the advantages to be had in this line of investments, and responded freely to calls for funds for extensions and improvements, so that in the following year (1895) the line was extended from Rockport to Elyria, a distance of seventeen miles. A new power station, with new equipment, was erected at Rockport, with power shops and repair shops adjoining, and during

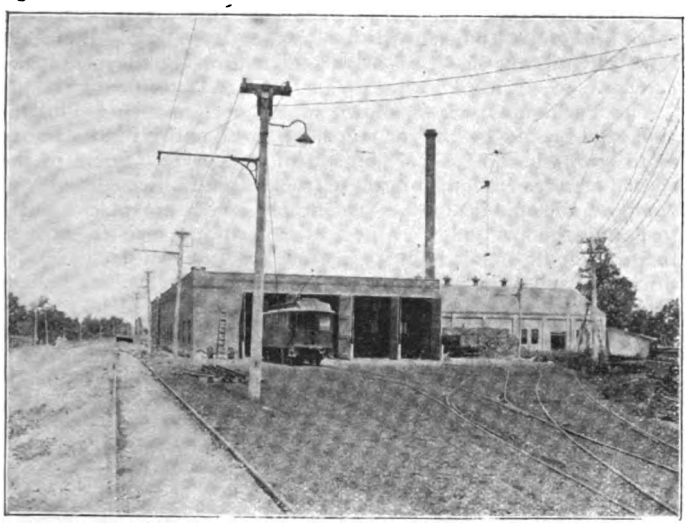


QUARRY SCENE NEAR BEREA, O.

Digitized by Google

the past year the line has been extended to Oberlin, an additional distance of nine miles, making the total distance from the city limits of Cleveland to Oberlin thirty miles, and, counting the distance from Rockport to Berea, gives a total distance of thirty-six miles. The company are now engaged in laying a double track four miles outside the city limits of Cleveland, and the roadway is being paved with brick by the county authorities.

The headway on each branch is one hour, so that the cars leave the Public Square in Cleveland every half hour and run over the same tracks as far as Rockport. The schedule time between Cleveland and Oberlin is two hours and ten minutes and between Cleveland and Elyria one hour and forty minutes, and between Cleveland and Berea one hour and fifteen minutes. The average



ROCK RIVER POWER HOUSE AND CAR HOUSE, C. B. E. & O. R. R.

speed is about twenty-five miles an hour, but in places a maximum speed of forty miles is reached. The fare for round trip to Oberlin is $1.10, or 60 cents one way. The round trip to Elyria is 85 cents and 45 cents one way, while to Berea the rates are 45 cents and 25 cents. These rates include a transfer to the lines of the Cleveland City Railway within the city limits. Tickets are sold and the cars are worked outside the city after the manner of steam passenger traffic. The company provide waiting rooms at the terminal stations, with a ticket office and an agent, while at Elyria tickets are sold from the hotel offices.

The express matter is handled at present by agents of the American Express. The milk traffic, which has increased to considerable proportions, or to an aggregate of about 1,000 gallons per day, is handled by the company on a special car, and this is scheduled to leave Elyria at 5 o'clock mornings and evenings. The charge for handling the milk is 1 cent a gallon from stations as far as Elyria; from points beyond a charge of 1½ cents is made. There is no charge for returning the cans. The milk stations at farmhouses and crossroads are provided with platforms to facilitate loading. The trade in this line has been entirely built up by the coming of the electric cars, as many of the farmers, who, for the most part were formerly engaged in the raising of grain or general farming, have been induced to buy cattle, and so have instituted a line of dairy farming.

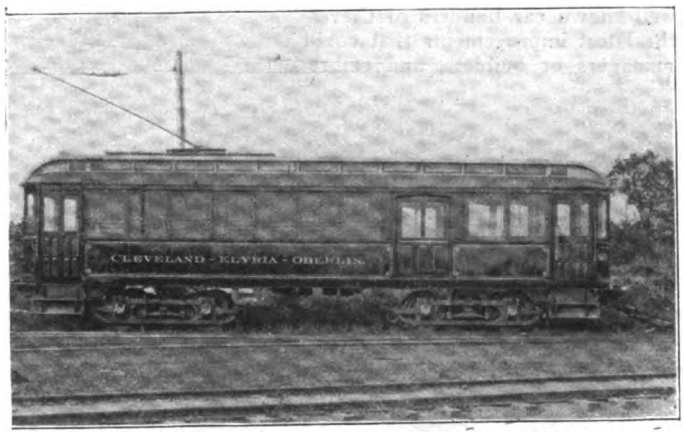
The region over which the line passes is uniformly level and the road is through one of the richest farming regions in the State, and is bordered on either side by comfortable farmhouses always within sight of each other, and in many cases having lawns with beautiful flowers, while they are surrounded by venerable shade trees of maple or elm, and frequently of gigantic size. There are also extensive orchards of apples and pears, and the landscape, from the diversity of products, including wheat, oats, corn and grass, presents a panorama of ever-changing and beautiful colors, backed frequently by a dark green outline of forests that are left to grow at the rear of the farms. Truck farms and vineyards are not wanting to make up in attractive features, while there are also a few stock farms for the raising of blooded horses. The terminal cities and villages through which the lines pass of course help out with their patronage, the most westerly of which is Oberlin, an especially attractive village, it being the seat of the popular college of the same name, which has an attendance during the school season of from 1,300 to 1,500 students of both sexes. The college buildings are twelve in number, many of them of modern design, and all located in or near the campus, which is a beautiful, shaded tract in the heart of the village. Elyria, the county seat of Lorain county, is a thriving little city of nearly 10,000, and furnishes a large traffic for the line.

Berea is also the seat of two popular schools, one known as Baldwin University, the other the German-Wallace College. There are also in this locality numerous stone quarries, from which much of the fine Ohio sandstone for building purposes is obtained, also flagging for sidewalks and curbs. The large flagging blocks are also used to some extent for paving the street, and these two towns, Berea and Oberlin, can probably boast of the largest paving blocks to be found in the streets of any city of the country, as they are found three and four feet square, and sometimes as much as 3x6 and even up to 4x8 feet. They are not popular, however, and are being replaced by modern brick paving.

ROADBED AND OVERHEAD CONSTRUCTION.

The line for the most part runs along the highway just outside the wagon path, but in some cases in order to cut off a long curve it is located for a few miles on private right of way through the farms. The route being generally level, only a little grading was required; the roadbed is slightly turnpike to provide for drainage. Only on the new extension between Elyria and Oberlin is any extensive filling required, and on this extension the roadway was widened to provide for the track, the farmers giving to the company a border all along their holdings. The culverts and underground work where required are all of solid masonry and steel girders, no woodwork being employed. In the more recent construction a 60 and 70-pound tee-rail of the Shanghigh type was employed and the joints are thoroughly bonded. The ties are placed two feet apart and thoroughly tamped. The tracks, notwithstanding the severe service and high speed, are standing up exceedingly well.

The trolley and feed wires are supported for the most part on wooden side poles with brackets. Turnouts are provided at suitable intervals, and these are equipped with spring switches and block signal lamps. There is also provided at each turnout a telephone station, through which the conductor of each car reports to the starter as his car arrives. At all steam railway crossings derailing switches are located, at which the conductor is obliged to go forward and throw the lever before his car can cross. This is a provision established by State law for all the street railways, and usually within the city limits the levers with



COMBINATION CAR, C. B. E. & O. R. R.

which the switch is thrown are attached to the side of one of the trolley poles.

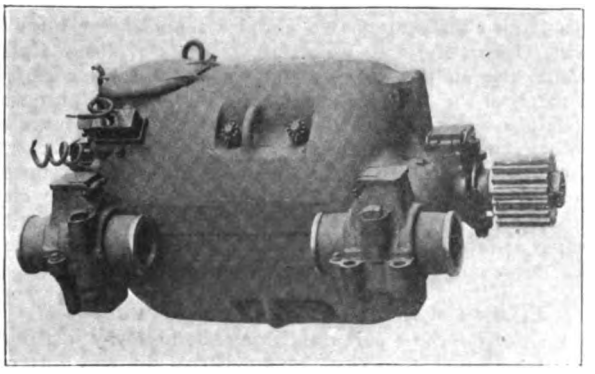
At Rocky River the line crosses the deep canyon over a steel truss bridge 1,200 feet in length and 140 feet above the roadbed. This is a county bridge, and for the privilege of crossing the company contracts to provide electric lights for illuminating the bridge and also for keeping the roadway clean.

POWER PLANTS.

The power for operating the entire system outside the city limits of Cleveland is generated in two stations, one located at

Digitized by Google

Rockport and the other at Elyria. The Rockport station was first erected, and the building is a brick structure with an iron smokestack. Near it is a long brick building for car house and repair shop, in which are also offices for the train dispatcher and superintendent. The steam is generated in Stirling water tube boilers of 900 h. p., and the power equipment consists of two Allis-Corliss simple en-



JOHNSON No. 84 50 H. P. MOTOR, C. B. E. & O. R. R.

gines, each of 350 h. p., and which drive by means of leather belts two Westinghouse generators of 250 kilowatts capacity.

The Elyria station is a wooden building, and the equipment consists of Stirling water tube boilers of 550 h. p. and two simple engines manufactured by the Slater Engine Company, of Warren, Mass. These have cylinders 22x42 inches, and are run at ninety revolutions, with a 17-foot flywheel weighing eighteen tons, with ball governors. These are each belted directly to a Walker generator of 250 kilowatts capacity. The auxiliary steam equipment consists of Berryman heaters and Ludlow Dun pumps. There is also a pump for fire purposes. The switchboard, with the exception of the meters, is equipped with Walker instruments. The feeders from both stations are coupled together and the current leaves the station at a tension of 650 volts, and the distances to which the current is carried from the stations are four, six, seven, nine and ten miles. The stations also provide for their own lighting.

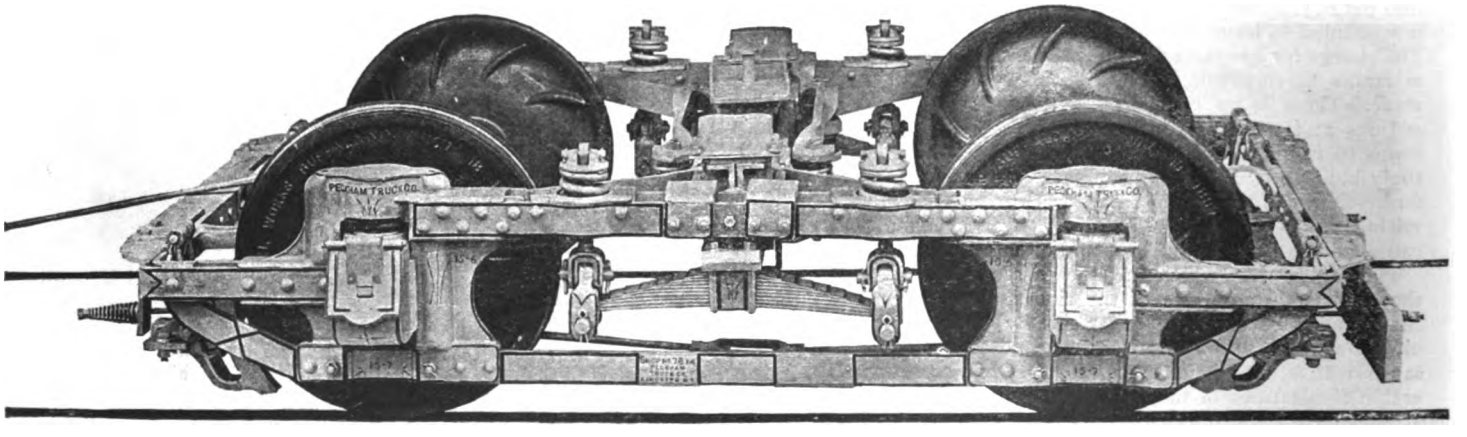
ROLLING STOCK.

The present equipment consists of sixteen double-truck cars, which were made by different builders; eight of these, however, were bought new this season and were manufactured after designs furnished by the company by the G. C. Kuhlman Co., the well-known car builders of Cleveland. These cars embody all the latest improvements that could be suggested by either the managers or builders, and embrace the combined experience had from the operation of this class of roads in this region, and, like the deacon's one-horse shay, they are as strong anywhere as in the weakest parts. Five of these new cars have smoking compartments, and the other three compartments for baggage and express. The interior of these, however, have the same finish as the main portion. The length of these new cars over buffers is 43 feet 6 inches, the bodies being 32 feet in length, and in width, 8 feet 5 inches outside. These are finished with a coach type of roof, with the deck lights arranged in sections and operated by an original arrrangement of worm and gear attachment.

The special features which distinguish these from some other make of cars are the arrangement of the braces and truss bars, which effectually prevent the body from humping in the centre and the vestibules from sagging. The window lights are of plate glass, with Forsyth shades. The interior finish is of cherry, with decorated bird's-eye maple ceiling. The seats are covered with rattan, are extra large and of the Hale & Kilbourne type. Each car is provided with a toilet closet and an icewater tank. The floors are double, with an air space to provide for warmth. The exterior is painted in bronze green, with special bronze trimmings, and decorated and lettered in gold, and all are provided with Meaker registers. Five of the new cars are mounted on extra heavy No. 15 trucks of the Peckham type, while the other three have trucks made by Dorner & Dutton, of Cleveland, the company now being known as Van Dorn & Dutton.

The Peckham truck is shown in the accompanying illustration, and is said by the management to be entirely satisfactory as to strength and ease of adjustment on curves. Some of the special features embodied in these trucks are that two sets of bars compose the middle of the side frame, which are placed apart to permit the swinging of a nest of half elliptic springs between them. The bolster is built up in truss form of two flat bars of a thickness and width suitable for the car bodies to be carried These bars are carried by adjustable posts. Secured to the top bar of the bolster are "King" side-bearing springs to provide for a slight rocking motion of the car body. The bolster is supported at each end on one or more half-elliptic springs, depending on the weight of the car body to be carried. The ends of these springs are carried in universal M. C. B. links, which permit of a motion both longitudinal and transverse with the axis of the truck, thus permitting the span of the springs to increase as the load comes on them, and at the same time acting as links providing for the transverse swinging of the truck bolster. These links are supported upon the side frames by coil springs, making three separate sets of supporting springs; i. e., the bolster half-elliptic, the bolster link coils and the journal box coil springs between the car body and rail.

The top bolster is guided between the upper bars to prevent motion in a direction longitudinal with the car body. These guides serve to transfer the draft of the motors from the trucks to the car body. The location of the half-elliptic springs between the bars of the side frames permits the drawing down of the bolster to the narrowest permissible width, thus shortening the wheel base of the truck. This location of the elliptic springs also imparts to them the properties of an equalizer, permitting any of the wheels to rise independently of the car body and supplementing in this direction the action of the yoke springs, located directly over the journal boxes. The motors are supported upon the transoms, which are rigidly secured to the side frames of the truck, which in turn are provided with corner brackets or braces to keep the truck in alignment. The wheel base is only 5 feet 8 inches for motors.



NO. 15 PECKHAM TRUCK, C., B., E. & O. R. R.

The new cars are equipped with Johnson motors, No. 34, 50 h. p. type. Some of the cars have a double equipment of motors, one a triple and one quadruple equipment, and from tests re-

Digitized by Google

cently made the company has decided to make the three-motor equipment a standard, as this number suits the conditions better than the two or the four-motor equipment, and all the cars are to be equipped in this manner. It is claimed that this is the only high speed road in the country operating a three-motor equipment with a suitable controller.

AIR BRAKES.

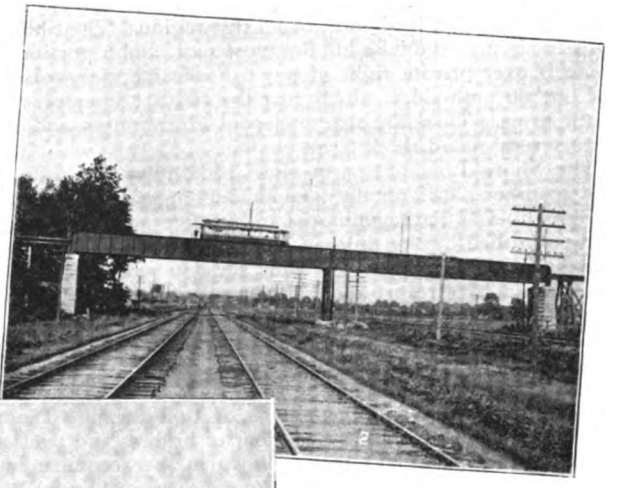
The entire equipment of double-truck cars, sixteen in number, is provided with air brakes of the Christensen independent motor compressor type. These brakes have replaced on some of the cars the axle-driven type of compressors made by the same and other companies, the high speed being too much for axle-driven compressors. The motor compressor in this case is placed in the vestibule, and these are to be provided with an automatic starting and stopping apparatus. The operation of the air brake equipment is very satisfactory, and the air whistles in connection therewith are considered almost a necessity on this class of cars.

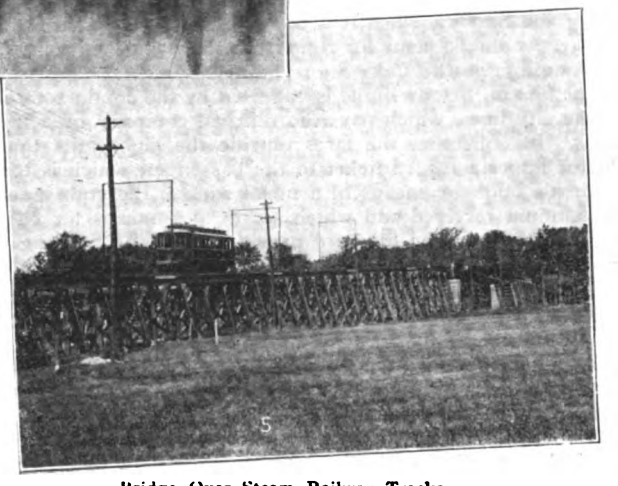
TRAFFIC AND MANAGEMENT.

The number of passengers carried during the year 1897 was 557,000. The income from this source, together with that from the freight and express, is a gratifying return for the money and skill invested. Mr. A. H. Pomeroy, of Berea, is president of the company; A. E. Atkins, of Cleveland, vice-president; L. E. Meacham, secretary, while the active management of the operation is in the hands of Mr. F. T. Pomeroy, treasurer and general manager, with offices at 614 Garfield Building, Cleveland.

Cleveland, Painesville & Eastern Ry. Co.

THE main line of this system, which extends in a northeasterly direction from Cleveland to Painesville, a distance of thirty miles, was the third of this class of lines to be built leading into Cleveland. The parallel branch, or Shore Line, which extends from Cleveland to Willoughby, a distance of 18 miles, parallel to the lake shore and between it and the main line, was





The Garfield Home at Mentor.

Excursion Train on Streets of Willoughby.

Lake Scene, Wade Park.

Bridge Over Steam Railway Tracks.

Long Trestle.

SCENES ALONG ROUTE OF CLEVELAND, PAINESVILLE & EASTERN R. R.

Two snow ploughs, manufactured by the Taunton Locomotive Works, Taunton, Mass., complete the rolling stock equipment, and these serve to keep the line open through the severest storms.

the most recently constructed of all, having been opened for traffic April, 1898. Both routes are through a farming region which is almost level, the total rise at any point not being over forty feet and none of the grades is over 4 per cent. Both lines

Digitized by Google

have their particular, attractive features, which differ in many particulars from those before described, and both parallel the lines of the Lake Shore & Nickel Plate Road. On leaving Cleveland the routes for the most part are along Prospect and Euclid avenues, the latter being noted as one of the most beautiful residence avenues to be found in the country, it being bordered to a great distance with handsome houses and beautiful and attractive grounds.

While the line is through a farming region principally, there are on the main line a number of small villages such as Euclid, Wickliff, Willoughby, West Mentor and Mentor, and it terminates at Painesville, a city of 5,000 inhabitants. At Mentor the line passes in front of the Garfield residence, which is still occupied by Mrs. Garfield, wife of the late President. To the south of the line the land rises gradually for a considerable distance, and the grade terminates in a ridge on a line with the road, which is about 200 feet above the lake and which is crowned at intervals for a number of miles with the palatial homes of some of the country's notable millionaires. The line passes in front of Wade Park and past Lake View Cemetery, in which stands the Garfield Monument, a landmark for all this region. The Shore Line runs in sight of the lake for the most part, and a portion of the route is over private right of way. Extensive vineyards border the line on both sides, which near the city are interspersed with truck farms. There are also numerous greenhouses, and on both lines several noted stock farms.

The Shore Line passes in close proximity to Gordon Park and to other parks on the lake shore, one of which, known as Willoughbeach Park, embraces twenty-five acres and is owned and controlled by the railroad company, and is being improved and beautified and provided with suitable pavilions, making it a very attractive resort about fifteen miles from Cleveland. On the Shore Line a new steel viaduct is being erected, the cost of which will be about $50,000, and which is borne jointly by the Lake Shore & Michigan Southern Railway Company (whose tracks the viaduct crosses), the Cleveland, Painesville & Eastern Railway Company and the village of Collinwood. The tracks of the main line also cross a number of bridges and trestles, one over the railroad tracks being shown in the accompanying engraving, and a bridge over the gorge of the Chagrin River at Willoughby, which was built by the railroad company at a cost of $50,000 and which, with the exception of the portion over the channel of the river is of timber construction. The bridge proper is of steel plate girders, reinforced by heavy truss girders above, and was constructed after designs and with equal strains as for the bridges on the neighboring steam railways.

The headway on the main line is one-half hour, and it requires two hours to make the trip between the squares of the two cities. The schedule speed is thirty miles per hour, including stops and the cars are frequently run at a speed of forty miles per hour. On the Lake Shore branch the headway is one hour except on Saturday and Sunday, when it is one-half hour.. The through fare is 45 cents and 80 cents for round trip, and 25 cents each way to Willoughby, on the Lake Shore branch.

The fare in the city limits is collected by the conductors of one of the city lines, which pays the railroad company on a mileage basis. In collecting the fares outside the city limits the conductor issues a record ticket to the passenger, which is torn off from his book by means of a metal square, the stub indicating the amount received and which serves as a means for checking the conductor. The cars are provided with the Sterling registers, but they are only used by the city conductors.

ROADBED AND OVERHEAD CONSTRUCTION.

The tracks between Euclid and Painesville are single and are located beside the highway and are laid with an 8-inch 68-pound rail, Wharton girder type. These are bonded on the under side by bonds made by Washburn & Moen. Gravel ballast is provided throughout the entire length.

Two trolley wires are employed of the figure 8 type and are equivalent to No. 000. These are supported by span wire construction except at the bridge and trestle, where brackets with flexible hangers are used. The span wires are 5-16" seven-span galvanized iron wire cable, tightened by bolts and insulated by 2½-inch globe strain balls. The trolley wire is hung with mechanical clips made by Hursburgh & Scott. No soldered hangers are used and the strain ears are fastened by rivets. The advantages of a double trolley construction is that temporary repairs may be made more easily, and if one wire should be broken it does not disable the line.

The feed wires, three each, extend in both directions from the power station. The first feeder running east ends and taps into the trolley at a distance of about four miles from the power house. By this arrangement the voltage near the power house is as low as at any other point, and which ordinarily would be too high, as the current leaves the station at a voltage of 700. The second feeder extends for about two miles farther, and the third to the end of the line, and both are tapped into the trolley every 1,000 feet. The same arrangement is followed to the west.

The wires for operating the company's telephones are also carried on the poles, or, in case there are trees in the way, the telephone wires are supported by the span wires. The cars are stopped only at stated points, and at these places a platform and waiting bench are placed and each stop is numbered. These stations are about 700 feet apart in the villages and 1,400 feet apart along the country road.

The tracks of the Willoughby branch, which, as noted above, was the last of this class of roads to be erected, are constructed after the best steam railway practice. The soil, which is sandy, is turnpiked, and the entire line is ballasted with gravel, which was brought in from gravel pits owned by the company, and which cost for this branch alone over $20,000. The ties are a little heavier than those described for the main line and spaced two feet apart. The rails, which are of the American Society of Civil Engineers' standard T-pattern, are of 73-pound section, and are rolled in 60-foot lengths, being bonded and connected as described for the other lines, except that the angle bars are unusually heavy, and the nuts with which the bolts are fastened are placed inside of the rails to facilitate inspection by the trackwalker. The overhead construction is like that described for the main line.

Stopping places are numbered and noted by signs attached to the side poles, and at important stations small lean-to houses are provided for shelter with open fronts, it having been found by previous practice that open front stations are more desirable, for the reason that if they are enclosed and provided with doors they become a rendezvous for tramps and undesirable persons, who are apt to leave them in a filthy condition.

The sidings are of ordinary lengths and are provided with spring switches, as described for the other lines, all of which were furnished by the Cleveland Frog & Switch Company. A portable telephone is carried on each car, and at the distance of a mile along the line taps from the telephone wires are brought down to two stiff wire loops in hoods which are attached to the poles about ten feet from the ground. The 'phone is attached by means of a pole and flexible cord. By this means the conductor can call up the office at Willoughby and at either end of the line. No call bell is carried, however, on these car 'phones, so that while the car may call up the office, the office cannot call up the car. A small telephone exchange is located in the office at Willoughby, with wires to both ends of the line to the barn, power house and the residence of the operating officers. It is stated that it would be almost impossible to operate this class of roads in safety without the use of the telephone.

POWER STATION.

The power station, main car barn, the repair shop and operating offices of both branches are located at Willoughby. The latter occupy a small dwelling which has been converted into railway offices and which fronts on the main street, near which the line turns and behind which stands the car house. The car house and repair shop are of brick and under one roof separated by a fireproof wall. The power for operating the shop tools is obtained from a 5 h. p. motor. There is one repair pit, and located within this on a small track an hydraulic jack for handling the armatures. An overhead crane provides for handling heavy parts. In the car house are three tracks, each of which is of sufficient length to accommodate three cars. There is also a small car house at Painesville, where one car is always left over night, and at Nottingham, on the branch line, is also a car storage house, which is of brick, with a single track; foundations are provided, however, for duplicating the structure. The waiting station and an oil house stand near this structure.

Among the special machines constituting the repair shop equipment is a motor air compressor of the oscillating type, which was manufactured by the G. E. Company. This compressor provides air under pressure, which is utilized for cleaning the car cushions. It is conducted by underground pipes to different points in the yard and shop by means of a suction cleaner manufactured by the Chicago Pneumatic Tool Company.

Digitized by Google

The dust is readily removed from plush cushions under a pressure of about 40 pounds. This is considered a very desirable auxiliary as a means for cleaning cars.

The power house is located a little east of the town in the valley of the Chagrin River and about one-quarter of a mile from the track. This valley is crossed by the long wooden trestle bridge noted above. The coal is delivered from the Nickel Plate Railway by way of a siding and trestle to the top of the building, the latter, as before noted, being in the valley, where the coal is dumped into the main hoppers, which occupy a space above the boiler. From these hoppers coal is drawn into vertical chutes which are attached to a weighing scale, and each charge is weighed on its way to the boilers. There is also an arrangement of tanks, in which the feed water can be weighed when tests are to be made.

The steam equipment consists of four Stirling water tube boilers manufactured by the Stirling Company, of Barberton, Ohio. These are each of 250 h. p. capacity and are equipped with Murphy stokers and settings, built by the Murphy Iron Company, of Detroit, Mich. In the stokers the coal is partially coked, so that the combustion under the boilers produces very little smoke. The auxiliary steam equipment consists of pumps made by the Dean Steam Pump Company, of Holyoke, Mass., and the condensers and feed water heaters are manufactured by the manufacturers of the engines.

The power equipment consists of two direct-couple units of 250 h. p. each and one of 500 h. p. The engines, which were built by the C. & G. Cooper Company, Mount Vernon, Ohio, are cross-compound, condensing 90 and 100 r. p. m. The two multipolar 200-kilowatt generators and one multipolar 500-kilowatt generator are of the General Electric type and are wound for a voltage of 700. The engines are fitted with single eccentric rings on the high-pressure cylinders and double eccentric on the low. There are two governors. One operates the throttle valve, the other releases a weight, which in turn operates a butterfly valve, cutting off steam whenever the speed is above a predetermined rate and at the same time operates a throw-out switch. The piping is so designed that either cylinder may be run by live steam independently.

ROLLING STOCK.

The car equipment is all of the J. G. Brill manufacture, and comprises thirty cars, six of which are open cars, five of them employed as trail cars, while the sixth is equipped with motors. The cars are 40 feet over all, handsomely built, and are modeled after steam railway practice. The closed cars were originally built with a single compartment, but more recently a partition has been erected to provide for a smoking compartment. The partition as well as the ends of the car are provided with sash and lights, giving a full view in either direction. The seats in the closed cars are of the steam railway type and provide for forty-two passengers. Some are upholstered in plush and others in rattan. The latter material is considered preferable, as it is more easily kept clean, and when stained can be restored by the use of an enamel paint. The open cars seat fifty-two people.

The roof structure of the open cars is of birch panelling, the alternate strips being stained cherry color. The carlins are exposed and are unusually heavy. Four six-inch ventilators have been added to the closed cars by the company. These pass through the ceiling and terminate in an ornamental crown above the roof. These provide for suitable ventilation during cold weather, when the passengers object to having the doors open. The ventilators are manufactured by the Star Metallic Ventilator Company, of Philadelphia. For illuminating purposes the cars are equipped with twenty incandescent lights in four circuits, two being placed in the sign case on the front dash. The object of two is to provide light in case one should fail. A lightning arrester is placed in the lighting circuit, together with a choking coil about 18 inches in length. These are located under the hovel in the vestibule. Circuit breakers are also placed in the hovel of each car in connection with the switches. The headlights are of the largest size, such as are employed on steam railways.

The cars are all mounted on Brill No. 27 trucks and are equipped with four No. 57 or 50 h. p. G. E. motors. The cars were originally equipped with two 75 h. p. motors, but the four-motor equipment is found to be preferable for high speed and for quick acceleration. Electric brakes are provided on all the cars which are regarded as very efficient and are economical to maintain, the expense for the renewal of brake shoes being much less than with ordinary brakes. The wheel brakes, however, are retained, and are used when it is necessary to bring the car to a standstill on grade, as the electric brakes, which are operated by current generated by the motors, are released when the wheels come to a full stop. As the wheel brakes are used very little, the head and shoe are cast in one piece. The wheels are 33 inches in diameter and were manufactured by the Terre Haute Car & Manufacturing Company, Terre Haute, Ind. The axles are 4½ inches in diameter and the journal boxes are what is known as the W. W. type, or Westervelt anti-friction box. In this device a small paddle is attached to the end of the axle, which dips up the oil and passes it on to the journal.

The sand boxes are located in the vestibule and are of capacity for several bushels. The portion which carries the valve gear and which extends below the floor is surrounded by a waterproof case, which prevents the accumulation of moisture or mud about the valves that is thrown off by the wheel. The hose which leads the sand to the rail is cut diagonally at the lower end, the open end being forward. This also prevents an accumulation of mud and dirt, which might tend to choke the flow of sand.

It requires fourteen cars ordinarily to cover the two lines, with four additional on Saturdays and Sundays. On the Willoughby branch and at the terminals of the main line the cars are allowed to lay over after each trip for an hour to allow the motors to cool off. This, it is found, is a very essential practice on account of the high speeds. In case the cars were to run continuously without this lay-over they would make about 443 miles a day.

The trolley wheels are cast from a special mixture and have an unusually deep flange. The bushing is large, being ⅝x2 inches, and the wheels last generally about a week. Ordinary wheels would wear out in one day on account of the high speed. These, as well as the gears, which are of cast steel, are purchased from Horsburg & Scott, local manufacturers.

An electric locomotive which is equipped with four motors serves to handle the construction train and in winter serves as a snow plough, a nose and flange being attached.

From extensive tests to obtain the total power consumed by the car at different speeds it was found that the rise in power slightly exceeded the rise in speed. The maximum power obtained was 153 h. p. during a start when a high speed was quickly attained. Running at a speed of twenty to twenty-five miles per hour the power was from 30 to 40 h. p.; at speeds of thirty to forty miles per hour, from 80 to 100 h. p. were required, and from a dynamometer test to ascertain the power for hauling a trail car the drawbar pull was found to be from 500 to 650 pounds to give a steady acceleration at a speed of from 18 to 34 miles per hour. From the tests it was assumed that a drawbar pull of 500 pounds would be just sufficient to overcome the friction of the car, and for a car weighing twenty tons the total friction is estimated to be from 20 to 25 pounds per ton.

The number of passengers carried during 1897 was 526,098, and for the first seven months of 1898, 349,528. There is also a considerable income from express and freight traffic. The express business is under the management of one of the express companies, who furnish their own messengers. A large number of people who do business in Cleveland or Painesvillle reside on the line of the road and provide a steady patronage, while the pleasure riding is a marked feature of this system.

The officers of the company are C. W. Wason, who is president, and who is also connected with other lines, as noted above. Mr. Wason began his railway experience on one of the city lines ten years ago, having succeeded his father, who had been identified with the Cleveland railways for a long period. H. A. Everett is general manager; J. A. Beidler, vice-president; Mr. F. S. Borton, secretary, and L. E. Beilstine, superintendent. The city office of the company is in the Garfield Building.

The Boston Subway.

AT a time when it has been officially announced that the entire Boston subway is practically completed and will shortly be thrown open to the public, it seems fitting to allude to some of the adverse criticism of some of the daily press, which have stated that the subway was not popular with the general public.

We think the best argument that we can offer is the picture which we print herewith, reduced from a photograph, showing the suburbanites of Boston heading for the Park street entrance of the subway at a little after 5 o'clock on a recent afternoon.

We also understand that the average number of people who

Digitized by Google

purchase tickets to enter the subway between the hours of 5 and 6 on any week-day evening is about 4,500 to 4,800. When we consider that this does not include those presenting eight-cent checks and those having passes who travel through the subway, we think the above a sufficient and unanswerable argument as to the popularity of this great undertaking.

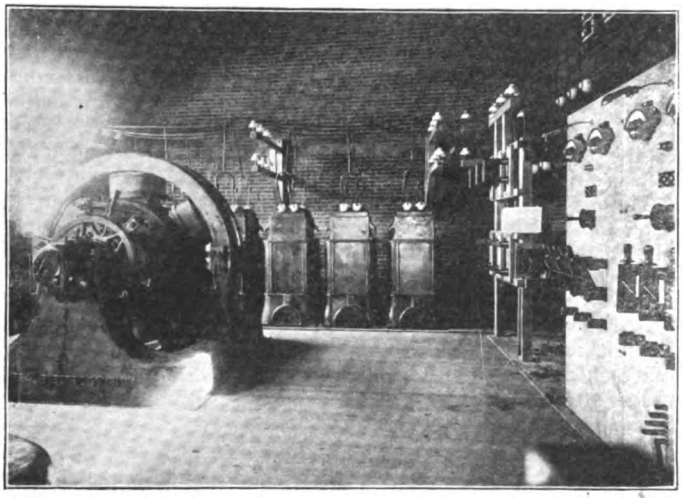
ENTRANCE TO BOSTON SUBWAY.

As to its engineering features, we think it is conceded by all those competent to pass on its technical aspect that it is one of the best designed and constructed examples of modern engineering skill of its kind. Considering that only a small portion of it has been open and that for only twelve months, it has evidently demonstrated itself to be a success.

The Buffalo and Lockport Electric Railway.

BY O. E. DUNLAP.

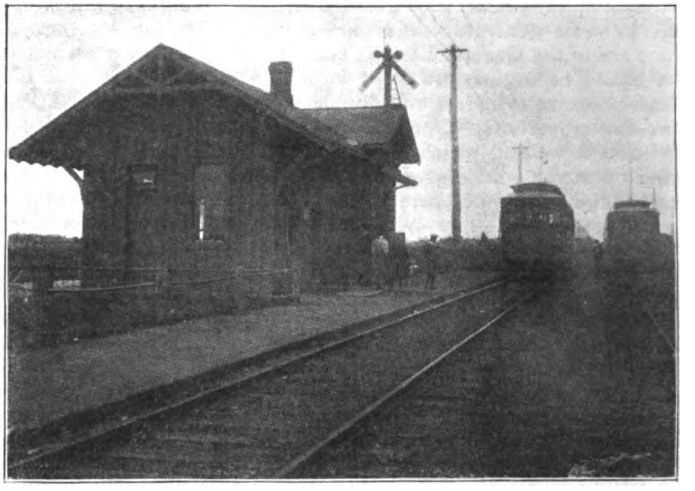
THE cities of Buffalo and Lockport, N. Y., are now connected by an electric railway, the service on which is very similar to that afforded by the Buffalo & Niagara Falls Electric Railway Company between Buffalo and the Falls. The company owning the line between Buffalo and Lockport is known as the Buffalo & Lockport Railway Company, and the men interested in the company are prominent in the line running to the Falls. The president of the road is Hon. W. Caryl Ely, who is also president of the Buffalo & Niagara Falls road. The general manager of the new line is Burt Van Horn, who occupies a similar position on the Buffalo-Falls road. The superintendent is C. K. Marshall, he being also superintendent of the other line mentioned. This makes plain that the interests of the two electric roads are mainly identical and that in many ways they will contribute to the success of each other.



TRANSFORMER ROOM, BUFFALO & LOCKPORT R. R.

The cars of the Buffalo & Lockport Railway are at present operated over the tracks of the Buffalo & Niagara Falls road from North Tonawanda to Buffalo, but very recently the Buffalo, Kenmore & Tonawanda line has been purchased by one interested in the Buffalo & Lockport road, and it is the general expectation that in the very near future the Buffalo-Lockport cars will have an independent entrance into Buffalo over the tracks of the line so secured. From North Tonawanda to Lockport the cars are operated over the old branch of the Erie road, which has been leased and transformed from a steam to a trolley road, this being the first transformation of the kind in Western New York. For this reason it has attracted much attention.

The distance from Buffalo to Lockport over the route is about 25 miles, North Tonawanda being situated about midway between the two terminal cities. The rails used on the Erie line were 60-pound, and it was found necessary to relay about one mile of track two miles west of Lockport, and in this work 80-pound rails were used. The contract for the reconstruction of the Erie branch was awarded to J. G. White & Co., and Mr. John A. Wilson had charge of the work for them. From North Tonawanda to Lockport the line has a single track, with turnouts at Martinsville, Pendleton Centre and one a short distance west of Lockport. It was necessary to bond the track, and in this work two gangs were employed, one working days and the other at night. A three-inch horseshoe bond, with No. 0000 wire, was used underneath the rail. About twenty days were consumed in this work.



CARS PASSING AT PENDLETON CENTRE, SHOWING TYPE OF STATION, B. & L. R. R.

In carrying out the contract Mr. Wilson used a construction train consisting of an engine, three flat cars and a caboose. The wire was strung with the train in motion, the wire being laid on the cross arms of the poles from the end of a boom on one of the cars. Each day about five miles of wire was run out and laid. The trolley wire is suspended from a double line on poles set 88 feet apart. On the poles on the north side of the track two 500,000 c. m. feeder cables are strung. On the south side of the right of way poles have been erected for a power transmission line from North Tonawanda to Lockport.

The poles of the transmission line are set 100 feet apart and three No. 0000 wires run along over the single cross-arm placed on them. The porcelain insulators used are the same as in service on the Buffalo-Niagara Falls power transmission line. The tops of all poles are 22 feet above the track. For about three-quarters of a mile in North Tonawanda the trolley wire is suspended on an arm support. Niagara power is being used to operate the road, the connection between the two transmission lines being made in North Tonawanda. The plan of the company is to feed the Lockport end from the transformer station in Lockport and the westerly end from a transformer station located in North Tonawanda.

Many advantages were secured by the Buffalo & Lockport Railway Company in their very clever move in leasing the old Erie branch from North Tonawanda to Lockport. It assured

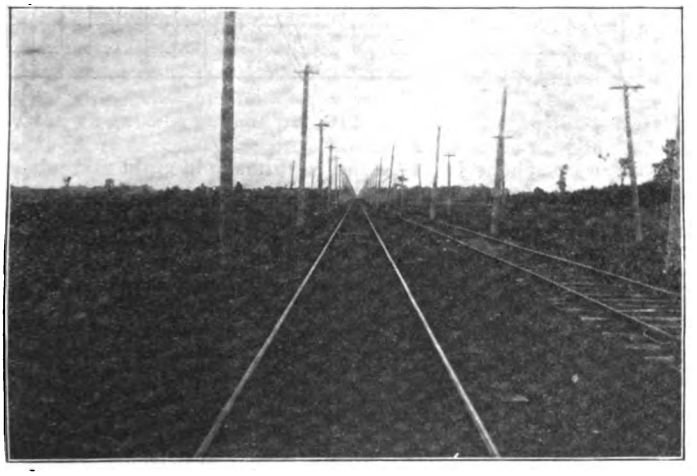
Digitized by Google

them of a splendid right of way, a recognized route of travel, well-built suitable stations, a good freight and milk business, etc. In order to handle the freight business to which they have fallen heir, they have purchased two electric locomotives from the General Electric Company. Each of these locomotives weighs 45 tons and is equipped with four No. 55 motors. They have a guaranteed speed of 15 miles an hour and have pulled as many as 28 loaded cars over the line. A significant feature of these locomotives is that they are identical with the locomotives to be made by the General Electric Company for the underground railway service in London, England.

The Buffalo & Lockport Railway Company have 10 cars, two of which are combination baggage and passenger and eight combination smoker and passenger. The color of the cars is yellow, exactly like the cars of the Buffalo & Niagara Falls road. Each car is fitted with four No. 57 motors, with a rated capacity of 52 h. p., the total horse power to each car, therefore, being 208 h. p. The Brill Company, of Philadelphia, built the cars.

The speed over the line is quite a little faster than that made by cars on the Buffalo & Niagara Falls road, and the time consumed in running from Lockport to Buffalo is a little over an hour. It is the company's intention to give a half-hour service between the two points. Under the Erie management four passenger trains were run each way every day between Buffalo and Lockport, and it is apparent that the electric cars will afford a better service. There was one freight a day between North Tonawanda and Lockport, and this the electric locomotives can easily surpass if necessity requires. A valuable feature of the company's rights is that it controls the Lock City road, and, under a franchise granted by the Common Council of that city, it has the right to handle freight through that city over the tracks of the local road between the hours of 11 p. m. and 5 a. m. The lease of the Erie gives unlimited freight rights at all times. Lockport is a city where considerable manufacturing is done, and considerable of the freight to and from these establishments will pass over the Buffalo & Lockport Railway Company's tracks.

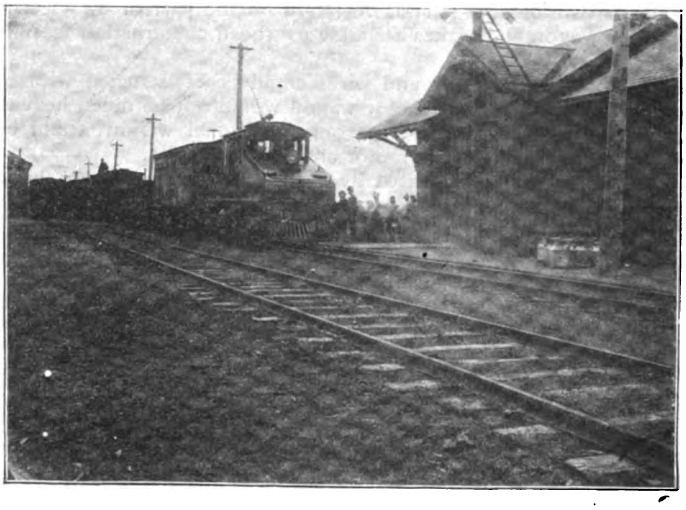
The company has constructed a brick car barn in the rear of the Lockport depot, where their cars will be kept. In this building the transformer room is located, as well as a convenient workshop. In the transformer room two 500 h. p. rotary converters, static transformers and the necessary switchboards have been installed by the General Electric Company. The switchboard has three panels and is of blue marble.



TEN MILES OF TRACK AS THE CROW FLIES, B. & L. R. R.

The possibilities of the cars making a rapid run over the line between North Tonawanda and Lockport is enhanced by the fact that for over 10 miles the track runs in a straight line, with not the slightest curve for that distance. The stations along the line from North Tonawanda east are Martinsville, three miles; Hoffman, four miles; Pendleton Centre, eight miles; Hodgeville, nine miles; Lockport, 13 miles. The road runs through a beautiful farming country, and the advent of the trolley is welcomed as the successor of the steam locomotive, because farmers recognize that there is less liability of their crops being destroyed by fires started by flying sparks from the locomotives. They also welcome a better passenger and freight service, and there is no doubt but that the road will become a factor of some consideration in placing their fruit on the market.

One of the ideal features of the construction of this new electric railway is the fact that it provides a right of way for a power transmission line from North Tonawanda to Lockport, and thus it is likely, in more ways than one, to become a material aid in developing various interests in Niagara county. Lockport is not so rich in power resources but that it is very pleased to feel the thrill of the industrial advancement consequent upon the presence of the transmitted power of the big generators in the central station of the Niagara Falls Power Company.



45-TON ELECTIC FREIGHT LOCOMOTIVE, B. & L. R. R.

For many years Lockport has longed for an electric line from that city to the shore of Lake Ontario at Olcott, and it is understood that the men back of the Buffalo & Lockport road will build this line at an early date, they seeing in it the prospects of good travel, not from Lockport alone, but from the larger centres of population, Buffalo and Niagara Falls. The country through which it would run is rich in fruit and general farm produce, and the freight traffic would be an important item, while it would also afford a better passenger service to a large section of country through which only one railroad runs at present. The company also have in contemplation the extension of their line down along the Erie Canal to Middleport, Medina, Albion and other places between Lockport and Rochester. In fact, the time may not be far distant when it will be possible to ride from the Queen City to the Flour City on cars driven at a high speed by Niagara power.

It may be mentioned incidentally that Hon. W. Caryl Ely, who has thus given his energy to the development of a second great electric railway, is vice-president of the American Street Railway Association. He is a gentleman who has been attracted to the electric railroad field by a full and proper conception of the wonderful possibilities of development the electric road brings to a locality through which it is run. He was the chief promoter of the Buffalo & Niagara Falls road, which has won pleasing success. Mr. Ely is not a temporary star in street railway circles. He is of the first magnitude, and, to use his own words, has "come to stay." In Burt Van Horn he has an able lieutenant, and it will be well worth watching the career of these two men in the electric railroad development.

Electrical Propulsion on Country Roads.

BY JAMES ASHER.

IN the application of electricity to wagons on country roads, it has hitherto been considered necessary to have a battery on the wagon to supply electricity to the electric motor. Little use has been made of batteries in this regard because of their inconvenience, weight and cost of maintenance.

I will now propose a method of using electric motors on common roads. Two parallel overhead wires may be supported either by cross-arms on posts or by wires stretched across the road overhead. There may be two trolley poles extending up from the wagon to the wires. Each trolley pole supports at the top a heavy bare conductor bent into an approximately elliptical form, which may be several feet long, which is pressed up-

Digitized by Google

wardly against the line wire and is transverse thereto. It will now be understood that the electric current enters the elliptical wire at the head of one trolley pole, descends along a conductor on this pole, traverses the electric motor, which is mounted under the wagon, then ascends the conductor on the second trolley pole and traverses the elliptical rubbing conductor at the head of this pole, and finally enters the second overhead wire. The elliptical conductor at the head of each pole would be similar to that of Siemens, which is used on European electric railways. The trouble arising from the jumping off the trolley wire by the trolley is avoided by means of the rubbing conductor. This method of leading the current of electricity to and from the electric motor allows considerable laterial deviation on the part of the electric motor wagon and makes a simple overhead construction feasible at corners.

Such a line of poles and wires could be constructed without great expense, and the motor wagon would not be much heavier than an ordinary wagon; the only additional weight would be that of the small electric motor and its accessories.

A motor wagon, actuated by a current of electricity arriving by one of the overhead wires and returning by the other, could draw several loaded trailers. In some cases it would be advisable to have a heavy motor wagon built expressly for drawing trains of loaded wagons or carriages. In this manner some of the advantages of an electric railway might be secured without incurring the great expense of a line of ties and rails. Much steeper grades could be ascended than is the case with electric railways. Only the motor wagon would require a steering mechanism. Means of reversing the motion of the traction or motor wagon would be provided in most cases. The wagons in the train should be furnished with brakes. Perhaps as many as ten heavily loaded wagons could be drawn by one motor wagon of about 12 h. p. By means of this system several neighbors might frequently unite to form a train of wagons loaded with grain or other produce for market even thirty miles away. Only one person would be required for the management of the whole train.

This system of electric traction would possess not only the cheapness of the telpherage system, but also the ability to draw loads which the telpherage system could not move. In the winter season, when the ground is covered with snow, the motor wagon could draw enormous loads of produce or of passengers on a train of sleighs. Thus, on common roads, much of the work that is commonly performed by horses could be electrically performed with facility, speed and small expense.

Power Consumption in Electric Railroading.—III.[1]

BY. S. T. DODD.

ACCELERATION.

The next question which demands our attention is the power expended in acceleration. How many pounds of pull does it take to give a certain weight a certain velocity in a fixed time? What accelerations are usually attained in practice? and what are the attainable and limiting rates of acceleration?

The answer to the first of these questions is mathematical rather than experimental. If a force P acts upon a weight W to produce acceleration, leaving out of account for the present the force necessary to overcome friction, the acceleration F will be equal to $32.2 \times P/W$. Forces and weights being expressed in pounds and acceleration in feet per second per second, it will be more convenient in what follows to express acceleration in terms of the gain in one second of velocity measured in miles per hour, which we will write F_m. $F = F_m \frac{5280}{3600}$. Transforming the equation above we get $P = \frac{FW}{32.2}$. Substituting for F, $P = F_m W \frac{5280}{3600 \times 32.2}$ or $P = F \times W/21.9$, and if $W = 2{,}000$ pounds we get the force per ton equal to the acceleration multiplied by 91.5, or pounds per ton $= F_m . 91.3$

The curves in Fig. 3 show the accelerations which are obtained in actual practice. Curve No. 1 shows a start of an 11-car train on the Chicago, Burlington & Quincy R. R., copied from data given by Mr. Wm. Forsyth in an article "Tests of Locomotives in Express Service," published in the "National Car and Locomotive Builder," April, 1893.

Curve No. 2 shows the start of a Manhattan Elevated train, taken from an article by Mr. George L. Fowler in the "Railroad Gazette," March, 1897. Curve No. 3 shows the start of an Akron, Bedford & Cleveland electric car. Curve No. 4 is a corresponding observation made on the Cleveland, Painesville & Eastern Road. Curve No. 5 is taken from an article by Mr. W. B. Potter, engineer of the railway department of the General Electric Co., and shows the starting curve of a car equipped by that company with a view to experimenting upon very high accelerations.

The table opposite shows the number of pounds per ton used for acceleration in the various starts shown in these curves, calculated from the acceleration by the formula derived above.

The limit of possible acceleration in railroad work is naturally fixed by the slipping of the driving wheels. It can be shown that the start represented in Curve No. 5 is very near to this limit. It is generally acknowledged that the adhesion of wheels to rails is, under good conditions, one-fourth of the weight upon them, and under ordinary conditions, one-fifth. If we assume, however, one-fourth, and assume moreover that the whole weight of the car rests upon the driving wheels, it will be seen that the limiting accelerating force is about 500 pounds per ton, and allowing 30 pounds per ton for frictional resistance, we have about 470 pounds as the limiting acceleration. Curve No. 6 shows this limit. That such starts as this are not uncomfortable, if made smoothly, is testified to by the fact that we experience negative accelerations of comparable amounts upon our interurban cars without feeling any discomfort. I have myself noted a stop from 25 miles an hour within 90 feet, and from

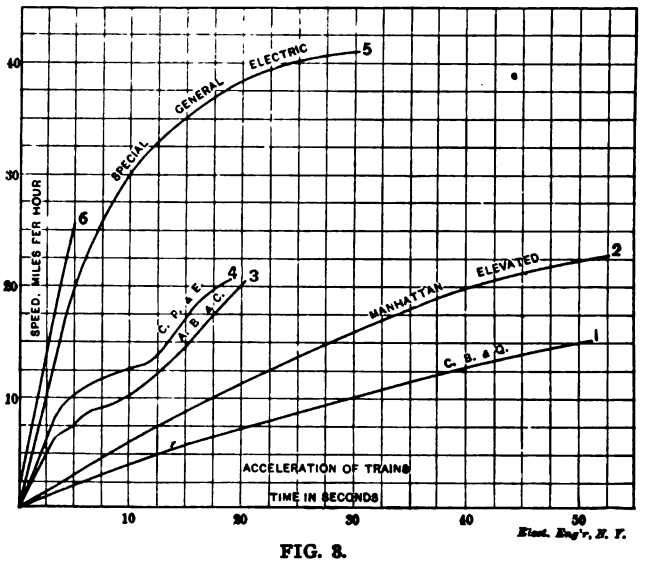


FIG. 3.

41 miles per hour I have seen a stop made in eight seconds. As these represent a negative acceleration of 475 pounds per ton it is evident that the rails were in pretty good condition and that we had an adhesion of about one-fourth. I might note that both these were emergency stops and a little more sudden than ordinary, but I am told by motormen upon our suburban roads that, with brakes in good condition, they can always make a stop from 50 miles an hour in 5 poles, or 450 feet, which represents a negative acceleration of 365 pounds per ton. From these facts I think we can conclude that the limit of possible acceleration is only fixed by the adhesion of the wheels to the rail, or by the willingness of railway managers to expend extra power for the sake of increased schedule speeds.

GRADE RESISTANCE.

It is often stated as an advantage of electric traction that an electric car is able to mount steeper grades than a steam driven train. This statement, while true, is often misstated, or rather misunderstood by those who make it. The advantage does not lie, as many seem to think, in the electric current per se, and when steam railroad managers think it advisable to equip an 800-ton train with 8,000 horse power in motive power, the difference will not be as apparent as it is to-day. The force necessary to lift a train up a grade is the same fraction of the weight of the train that the rise of the grade is of horizontal length. As an example of some of the grades we meet in practice, we may note that the Cleveland City Railway is operating on Woodland avenue a grade of 9 per cent., and pulling trailers on that. The Cleveland Electric Railway is operating on Seneca street hill a

[1]Paper read before the Civil Engineers' Club, Cleveland, O.

Digitized by Google

grade of about 11 per cent.; the Akron, Bedford and Cleveland Railway is operating on North Hill, Akron, a grade of 13.5 per cent. To compare these resistances with those ordinarily experienced in acceleration, the latter part of the table below shows the number of pounds traction per ton of train necessary to mount such grades. An inspection of the table shows that the tractive effort necessary on ordinary grades is comparable with that necessary for such acceleration as we ordinarily meet in electric railroad practice.

POWER CONSUMPTION.

Let us apply the data of the foregoing discussion to some problems in order to determine the power expended in particular cases. Let us take as a first illustration an ordinary city car. These cars, together with the equipments, will weigh about 12 tons. As may be noted any night after 12 o'clock going out either Prospect street or Detroit street, the maximum speed which such equipments will attain on a level after the period of acceleration is past, is about 20 miles per hour. Applying our formula for train resistance, $18 + .2V$, the frictional resistance of such a car at this speed is about 22 pounds per ton, giving us a horizontal effort of 264 pounds necessary to propel a 12-ton car. 264 pounds at 20 miles per hour is equal to 14 horse power. Assuming that the efficiency of such motors as are ordinarily used at this speed is about 75 per cent., this gives an input at the trolley of 18.8 horse power or 14 kilowatts, which, at 500 volts is equivalent to 28 amperes. This represents approximately the amount of current necessary to propel such a car.

As a second illustration let us take as an example an ordinary double truck inter-urban car. The weight of the car body and truck empty is about 15 tons. The motors ordinarily used for

HORIZONTAL EFFORT FOR VARIOUS ACCELERATIONS AND GRADES.

ROADS.	A	G	H E. PER TON.
C. B & Q STEAM	1		36.5
MANHATTAN ELEV. STEAM	2		55
A. B. &. C. ELECTRIC	3		183
C. P. & E.	4		238
SPECIAL G. E.	5		348
LIMIT			470
WOODLAND AVE.		9%	180
SENECA ST.		11%	220
NORTH HILL		13½%	270

such equipment weigh about 3,000 pounds. We can estimate the total weight, including two motor equipment, and a few passengers, at about 20 tons. You may note that these cars run upon a level at a speed of about 28 miles per hour. Applying our formula we get 23.4 pounds per ton, or a total of 472 pounds horizontal effort necessary for propulsion. At 28 miles an hour this is equivalent to 35 horse power. Figuring the efficiency of these larger size motors at 82 per cent., this gives us 43 horse power, or 32 kilowatt input, which, at 500 volts, gives 64 amperes, or 32 amperes per motor as the ordinary running current.

Another interesting question is—What should the starting current amount to in cars of this weight? If we take the curves of acceleration which are plotted upon the sheet for the A. B. & C. car, you will see that at the maximum as the acceleration begins to fall off, which corresponds to the point where the controller is entirely cut out, we have an acceleration amounting to 1.25 miles per hour per second. This is equivalent to 114.5 pounds per ton, or for a 20-ton car about 2,300 pounds horizontal effort necessary at this point. As the speed attained with this pull is approximately 18 miles per hour, then the motors are delivering about 110 horse power; figuring the efficiency of the motors at 80 per cent., we get a total input of 138 horse power or 103 kilowatts, which at 500 volts, represents 206 amperes as the starting current.

Let us consider as a final example the cars of our latest interurban road, the Lorain and Cleveland Railroad. No tests have as yet been published on this, but we are promised by the engineers a complete set of tests as soon as the road is in running shape, and when such tests are published we will have some basis for judging the reliability of these figures. Such cars will weigh empty about 15 tons, or 30,000 pounds. They are equipped with four motors, and while I am not acquainted with the data of these motors, they must weigh in the neighborhood of 3,000 pounds each. We can safely estimate the weight of car equipment as 22 tons. You will note in riding on the cars that a speed of 35 to 45 miles an hour is common, and that after you have gone a mile or so from a stop you attain a speed of 50 miles per hour.

What current do the motors take to propel the car at this speed?

The train resistance on a level is $(18 + .2V)W$; since in the present case W is 22 tons and V is 50 miles, we have 616 pounds effort necessary for propulsion. 616 pounds at 50 miles per hour is 82 horse power, which represents the output of the motors at full speed. For motors of this size we may estimate the efficiency at about 82 per cent. This means 100 horse power input to the motors.

As for voltage, a visit to the power house will show that they carry a pretty high voltage (about 600) and heavy feeders, so we can estimate they get 550 volts at the motor terminals; 100 horse power at 550 volts is 135 amperes. My estimate based on the data I have given you is that it takes about 135 amperes to propel these cars after they have attained full speed.

Another interesting question is—How much current does it take to start these cars? If we are allowed to make some assumption we can estimate somewhat near. These cars seem to me to accelerate at the start a little slower than our ordinary suburban cars. Let us suppose they start with an acceleration of 150 pounds per ton. 150 pounds per ton is a total effort of 3,300 pounds. To this must be added about 23 pounds per ton for frictional resistance, making a total of 3,800 pounds.

How much current flowing through these motors will produce a horizontal effort of 950 pounds per motor? To determine that, it will be necessary to know the speed of which the motors are capable at some definite voltage at this torque. We may note from the car windows that a speed of 35 or 40 miles is very soon attained, but it is not until after we have traveled a mile or so that we reach a speed of 50 miles per hour. We will not be far from correct if we figure that the car maintains an acceleration of 150 pounds per ton up to about 25 miles per hour, and then as the controller is entirely cut out the motors continue to speed up and current falls off together with the acceleration. An effort of 3,800 pounds at 25 miles per hour is about 254 horse power. Assuming again the efficiency of the motors at 80 per cent. we get an input of 317 horse power, or 236 kilowatts. At 550 volts this indicates a current of 430 amperes as the probable current during the period of acceleration.

In conclusion, let me repeat again the statement I made in the beginning. It often seems that the equipment of a single car with one or two hundred horse power in motive power is an unnecessary waste of power, but when we come to consider the weight of car and loads we are operating—the rapidity with which we are compelled to accelerate these weights on account of our frequent stops and the grades which our ordinary highways compel us to climb, we see that ordinary mechanical principles justify the demands of practice for heavy equipments.

The Canon City-Cripple Creek Power Transmission Plant in Operation—Mines Run by Electricity.

AT noon on August 17 Governor Alva Adams pressed the button which was the means of putting in motion the massive machinery of the Colorado Electric Power Company, at Cañon City, Col. The electric current was transmitted to motors at the Cripple Creek gold mines, twenty-four miles distant, where arrangements have been carried out to have electricity take the place of the usual steam power equipment that has heretofore been in use. This means the successful accomplishment of another big undertaking which adds to Cripple Creek's claim as the foremost gold producing camp in the United States, and at the same time records another instance where electricity was considered as the power par excellence for mining purposes by a community of practical men.

In brief, the scheme is to generate electricity at Cañon City, which is in the midst of extensive coal fields, and transmit the

Digitized by Google

power to Cripple Creek, where coal sells at a high figure. This will enable mines to be operated at a profit that have heretofore been close to losing propositions, and at the same time effect a very great saving in running expenses with the large producers. This promises to be a very important point in the future development of the camp.

The plant is one of the largest and best equipped electric power concerns in the West. The equipment consists of three Hamilton-Corliss engines, with a combined capacity of 9,000 h. p. direct connected to three Westinghouse three-phase generators of 2,100 kilowatts capacity, wound for 500 volts, making three separate generating units, one of which will always be kept as a reserve in case of emergency. For exciting the fields of the main dynamos there are two "Kodak" exciter outfits, each of which is capable of exciting all three of the main dynamos.

The engines are supplied from a battery of Heine safety tube boilers, and the exhaust steam is taken care of in a surface condenser. The air and circulating pumps and feed pumps are all of the "Snow" make.

There have been installed at the main station four transformers that step up from 500 to 20,000 volts, at which pressure the current is delivered to the transmission line. The first sub-station is near Victor, on the saddle between Battle Mountain and Bull Hill. The location of the second sub-station is on the saddle between Gold Hill and Globe Hill, near Cripple Creek. At each of the sub-stations the current steps down by means of transformers to 500 volts, at which pressure it is delivered to the motors in the mines. In addition, lights are to be supplied from the same wires used to furnish power.

The construction of the transmission line is most substantial; particular pains have been taken in protecting it from lightning troubles. In addition to the lightning arresters in the generating station at Cañon City and in the sub-stations lightning arresters have been installed at a number of points along the transmission line, the "Wurts" arrester being adopted throughout the installation.

It should be mentioned that in addition to the twenty-four miles of line between Cañon City and Cripple Creek there is about six miles of line over the camp, which will make the total length of the system about thirty miles. The work of constructing this system was commenced last September, and after nearly twelve months everything is in readiness. The entire line is patrolled by experienced linemen; they carry with them a telephone specially adapted for their work, which they connect with the main line at any point, and send in word wherever they find a break. Western Union call boxes are stationed along the line, and through them the patrolman must report where he is every hour.

The main station of the Colorado Electric Power plant is a substantial structure, 140x106 feet, constructed of brick, stone and cement, with steel trusses and corrugated iron roofing, and allowance has been made so that the entire plant can be duplicated without the addition of another smokestack or extra condensers.

This plant has cost probably not less than $750,000. The company has among its stockholders Mr. John D. Rockefeller, Mr. Andrew Carnegie, and others of like prominence.

The transmission line was erected under the supervision of the Mountain Electric Company, in Denver, for which they used a specially designed insulator, gotten up by them. This company by careful and painstaking work has gained a reputation as being second to none in this section for transmission construction work. The generating apparatus was installed by the Westinghouse Company and the steam equipment was put in under the supervision of the Stearns-Rogers Company, in Denver.

It has been carefully computed that there will be a saving of 25 per cent. in the operating expenses of the mines if electricity is used, in so far as the matter of hoisting the ore, running drills and doing whatever steam can do is concerned. Then, again, there can be no question as to the superior convenience.

Water Power Plants in the South.

THE Columbus Power Company, of Columbus, Ga., has recently let a contract for the construction of a stone dam and power house for the purpose of developing 8,000 electrical horse power. The head under which the wheels work is 40 feet, and the contract for these wheels has been let to the Holyoke Machine Co., Worcester, Mass. One pair of 39-inch wheels will be used to drive a 900 kilowatt generator at a speed of about 200 revolutions. Separate wheels will be used to drive two exciters. Each exciter will be large enough to excite all of the generators. The company proposes to install only about three generators at first and will prepare their power house so that additional wheels and generators can be added as the company's business will warrant.

Mr. Wm. C. Whitner, who has recently been acting as Southern agent for the Stanley Electric Mfg. Co., of Pittsfield, Mass., has resigned this position to accept that of chief engineer of the Columbus Power Co., and in the future will devote his attention entirely to the engineering of power transmission work.

Another plant in which Mr. Whitner is interested is that which is about to be built by the Spartan Power Co., of Spartanburg, S. C. This company will develop water power ten miles distant from the city of Spartanburg, on the Pacoiet River, transmitting about 1,000 horse power to the city at a high voltage; probably 12,000 volts will be used. A sub-station will be built within the city limits, and step-down converters will be used to reduce the voltage to 2,000. It is estimated that all of this 1,000 horse power will be required to light the streets and to furnish lights and power to the citizens. The details of the plant have not been worked out beyond the fact that a stone dam and power house will be built, and two 400 kilowatt multiphase alternators will be direct connected to horizontal wheels. It is proposed to use enclosed alternating arc lamps of 2,000 c. p. each.

ELECTRIC LIGHTING.

Testing Arc Light Circuits.—I.

BY W. H. MARKLAND.

A SUBJECT that has not received the attention it deserves by electrical writers and by a very large number of managers of central and isolated plants operating series arc lamps is that of testing circuits for grounds, escapes and e. m. f. of circuits while current is on. My observation is that about nine-tenths of the arc light stations rely wholly on the magneto call bell for all testing. Why this should be in these days when reliable high reading voltmeters can be had at reasonable prices is hard to understand by one who has had the use of the above. Every station manager should, and no doubt does, wish to know the state of the various circuits while current is on. Both in respect to leaks or grounds and the e. m. f. required for lamps. We all know that grounds come on and go off, also that escapes occur under the high e. m. f. of the dynamo that will not show up by magneto test. These grounds are often troublesome and hard to locate by magneto, but with the voltmeter the grounds cannot only be detected, but their nature, either "dead" or escape, told and their location ascertained with great accuracy, all this being done in the station by superintendent or engineer in "just no time."

The following is an illustration of actual practice in the writer's experience: A ground showed up in testing with a voltmeter that could not be detected by the magneto. Test showed it to be located between the first and second lamp on negative side of circuit of 45 lamps. Trouble men found the line wire down on guy wire to telephone pole in location indicated; the covering of wire had not cut through and weather was dry, thus no damage resulted. Had this not been detected noisy telephones and possibly burn-outs would have resulted later on.

In another case an escape was detected by voltmeter on circuit of 24 lamps, 10 lamps out from positive side. Trouble men found a wire down on iron work in location indicated, in building over shavings where, if the insulation of the wire had begun to burn, it might have caused a fire. The above are only two of many cases where escapes that the magneto would not show up have been located by a voltmeter. The voltmeter is particularly valuable in locating slight grounds during seasons of dry weather in order that the lines may be in good order and clear for the rainy season, which, we all know, causes the superintendent no end of trouble and fireworks on account of all the weak points in the insulation breaking down at one time. With large dynamos, such as 125-lighters, it is especially valuable to know all the weak

Digitized by Google

spots of lines. In case of a dead ground the same can be located with great accuracy. The time saved by being able to send trouble men to the exact spot where the ground is will more than pay interest on cost of voltmeter.

Another good use of the voltmeter is in the event of arc circuits being crossed with other wires to tell what class of wires they are, either low tension, direct current, alternating current, arc, or trolley wires. The writer has been able to tell by a voltmeter when an arc circuit was crossed in one case with a 110-volt circuit, another with 500-volt trolley and one with a telegraph circuit. As it was known where the arc circuits were close to wires of the nature indicated, there was no difficulty in going to almost the exact spot.

Another good use of the voltmeter is to test the e. m. f. of a circuit of lamps. In this way the average e. m. f. of each lamp may be figured out, and if too high or low the lamps adjusted to the proper length of arc. The writer had one case where he was helping out a friend. By taking the total e. m. f. of a circuit when the current was on, and after deducting for line wire and dividing by the number of lamps, it was found that each lamp was taking 55 volts, or 7 volts more than necessary per lamp, or for the 60 lamps, 420 volts, or nearly enough more than necessary to run nine additional lamps with lamps properly adjusted. I have not mentioned current, it being assumed on series arc circuits that it was normal at about 9.6 amperes. In this case the lamps were afterwards adjusted lower and more of them put on the dynamo. The superintendent of the station was a first-class man, but his directors could not see the use of these new-fangled affairs. Possibly now, when they find that more lamps can be run from the same dynamo and coal pile, they may think differently.

Another good use of the voltmeter is in testing the dynamo, especially after making repairs. Without the voltmeter we simply load up the dynamo with the number of lamps it is supposed to run and let her go. The lamps may take anywhere from 40 to 60 volts, and it is not known whether the dynamo is doing its proper work or not. But with the voltmeter the exact e. m. f. the dynamo is generating can be read off and the dynamo be loaded up until it is generating its full e. m. f., even with more or less than its correct number of lamps. The writer generally tests dynamos after repairs with the greatest number of lamps they will carry, or up to the point of flashing or the current falling, and by reading the e. m. f. it is known how many lamps can be put on the dynamo in the future. This is a case where both the dynamo and lamps are tested to see that each is right. For detecting slight or bad grounds to frame of dynamo the voltmeter comes in very handy. On one occasion a cross in the dynamo field was reported to me by a man of no mean ability. The magneto would not tell the story. The voltmeter located the trouble in the armature. As we had an extra armature and no extra field, we thought the voltmeter half paid for itself on that one occasion. Now, some may say that all this is very nice, but it costs money to get voltmeters and multipliers, and that the superintendent has plenty to do without all this in looking after the coal supply, to pacify a customer who wants lower rate, to see that Smith's light is as good as Jones' and to be generally courteous to customers and properly explain that electricity is in its infancy, and a thousand and one things that go to while away the weary hours of the superintendent so he may object to any more work. But when we consider that one can figure out the e. m. f. taken by lamps and resistance of grounds by tests made every evening and morning of 10 loops and record the same without hurry in 10 minutes, it can be seen that the superintendent can do the same and yet have a few minutes during the day to talk to carbon agents.

Some articles have been written about testing arc circuits by means of a galvanometer. While the writer is thoroughly familiar with the galvanometer and bridge, he has never been able to get any results on an arc circuit that were worth a cent, and came to the conclusion long ago that the galvanometer should remain with telegraph lines, where it originated.

THE ALBION POWER COMPANY, which from an electric plant situated at Waterport on the Oak Orchard Creek, is to supply Albion, N. Y., with lights and power, has recently been organized with a capital of $50,000. They will in the near future put up a brick power house with an iron roof and install an 80 light Brush machine and two 1,500 light alternators. The line, consisting of No. 6 wire, will be 40 miles in length.

Positive and Negative Economies in the Operation of Small Electric Light Plants.[1]—I.

BY E. P. ROBERTS.

IT is generally considered quite sufficient to keep an account of expenditures and receipts, and to ascertain the amount of the balance at the end of certain periods, and if there is a balance, it is sufficient cause for jubilation.

Upon examination of a great many plants, I feel sure that a great many of them, probably the majority, could reduce their operating expenses from 10 per cent. to 20 per cent. if—First—they were better informed as to the conditions under which they were operating, and, Second—knew how to improve the conditions. It should also be noted that at the same time that reduction of expenses would be obtained, a better service would be given, with attendant better feeling on the part of the consumer, both public and private.

If we take up the consideration of the plant from the standpoint of a general superintendent, and desire to investigate its condition, we must first ascertain the useful results and the losses in each step, and then we can discuss changes either in the plant or in the handling of it, what such changes would cost, and the advantages resulting therefrom, and whether any or all shall be taken up.

We may start as follows:

1st. The production of power at the dynamo pulley.

2d. The conversion of mechanical into electrical energy.

3d. The delivery of the electric energy to the various points where it is to be converted into light, heat or power.

4th. Its conversion as above stated.

Taking the above in order, we have first to consider the production of the driving power. In this case we will work backwards, that is, from the dynamo to the coal pile. If the plant is not direct connected, we will have belts and probably shafts. Are the belts tighter than advisable? If so, it may be because they are oily and dirty; this means increased depreciation as well as increased power. Evidently they should be cleaned. Possibly the belt centres are too close together, and this distance cannot be increased. Possibly larger pulleys can be placed, preferably (if not making belt speed excessive) larger in diameter, but if this is not feasible, wider in face. Will this pay? Suppose a belt transmitting 100 h. p. costs $100, and is running too tight and adds 3 per cent. (3 h. p.) to the friction more than it would do if running loose. Suppose to change to larger pulleys costs $75 and the extra belt costs $25 additional, making a total of $100. Probably the life of the belt will be increased 50 per cent., say nine years, as against six. We then have for twelve hours run for 365 days and 3 h. p. a total of 13,140 h. p. hours. If the additional coal is 4 pounds per h. p., and coal costs $1.50, we will have a saving of $39.42 annually, and a lessened depreciation of $5.55, or a total of $44.97. Not only a saving of 45 per cent. on the investment, but also less probability of breakage of belt, of poor lights, because of slip, of hot boxes and consequent cost of renewals, and less oil (though same is not figured), and most important, less probability of shut downs. The above is only a small item, but how many managers would spend $100 to save a belt slipping? The station superintendent must get along with resin.

Possibly the only remedy applicable is a tightener, not a very desirable method, but generally 99 per cent. more objectionable, wasteful and noisy than necessary because installed in the cheapest way possible. In such a paper as this we can not consider appliances in detail, so will pass on to the shaft. Here we find very little friction if the shaft is sufficiently stiff and in line, but if not, the friction may be from 15 per cent. to 20 per cent. of the rated load, and in many cases it is probably 10 per cent. more than necessary; therefore, for every horse power it transmits, it unnecessarily wastes in friction (if at the same rate as in previous example) $13.16 annually in fuel, a considerable amount in oil, and increases the liability of hot boxes. The remedy may be a new and larger shaft, or new and better boxes, or the present shaft may only need alignment. The trouble and its amount must first be ascertained and then the remedy applied. Suppose that the shaft transmits 200 h. p. and loses only 5 per cent. more in friction than it should, how much can we afford to spend to save that 5 per cent.? The direct saving would be $131.30 annually, which would be 10 per cent. on $1,313.00, and this is the amount we could not afford not to spend, and without considering the incidental advantages.

[1]Read before the Ohio Electric Light Association. Abstract.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 2, 1888.*]

Vol. XXVI. NEW YORK, SEPTEMBER 8, 1898. No. 540.

The Electric Railway Outlook.

THE meeting of the American Street Railway Convention at Boston this week will bring together perhaps a larger number of members and interested parties than has yet been recorded in the history of that eminently successful and useful organization, and we believe it is not the hope of having "a good time" that will draw many members hundreds of miles from their homes. Certain it is that the Association's proceedings are evidence of the great value of their meetings, many of the papers read at them being the only source of published information on some of the most important questions with which the electric railway official and engineer have to deal. What the technical progress of the year has to show will be very much in evidence at the exhibition of electric railway appliances held in connection with the convention. The ever present manufacturer's representative will need no assistance in setting forth that progress, and we are willing to leave it to him. But other topics besides apparatus will find the convention in a receptive mood. We could, for example, suggest a continuance of some previous discussions on the matter of freight business of electric roads. This is a field which, of course, many roads are debarred from doing by their charters, but most of the newer roads are so empowered but seem to have given the matter little more than passing thought. That an electric road is able to do a freight business at a lower rate than it can be done by the time honored horse and dray, goes without saying. This applies not only to the transportation of small packages, but seems to us particularly applicable to the handling of freight in bulk and of such weight as calls for special facilities. There is no good reason why in every manufacturing centre the electric railway company should not run a switch track into every factory and do the carting, so to speak, from the factory door to the steam railroad freight shed. In fact such a trolley carting scheme has only recently been evolved by the Chicagc General Electric Co., who have issued a circular to the owners of factories contiguous to their lines of road, asking for their business. The response has been most gratifying and it is more than likely that the company will soon have a trolley cartage business in full swing. When it is considered that an electric freight car can be built that can easily take a 35 ft. curve, it will be seen how easy the problem is of getting to the door and beside the outgoing delivery platform of most factories.

The above refers, of course, more particularly to urban electric railroads, but applies in a still greater degree to suburban and interurban roads. Already these classes of roads are beginning to make themselves felt as a factor in the country's transportation facilities, and to just what expansion such roads are capable is admirably illustrated in the description, begun in this issue, of the five electric roads centering in, or rather radiating from, Cleveland, O. During the past year these roads have carried considerably over a million passengers and have opened up a business which formerly did not exist at all. It is the old story of creating a demand by supplying the desired commodity. The experience had with these roads centering in Cleveland will no doubt be a guide to many others of a like nature, and those contemplating the building of similar roads will therefore find in Mr. Fairchild's description much to guide them in their equipment and operation. Here also, it will be noted, that a freight business will in time constitute no inconsiderable factor of the net income, and, if we are not mistaken, considerable of that business will be done in the shape of the haulage of loaded farm wagons, which will be taken bodily from the farm to the centre of the city. In anticipation of this class of traffic we need only recall that a rail truck is now being regularly manufactured, designed for the specific purpose of hauling farm wagons, and described in these columns recently.

There are still some problems in electric railroading on which the last word has by no means been said, and which relate to the nature of the source of power for hauling the car. Thus far the direct current has had undisputed sway on the car itself, and where the alternating current has been employed it has been merely in the form of a transmitter. Yet from time to time we hear of experiments looking to the application of alternating motors directly on the car. We believe that many electric railways would give a good deal to avoid the use of their heavy overhead feeders, and would welcome a system that would permit of using high tension feeding lines, with low tension local distribution. It is true that this can be accomplished by means of rotary transformers, and in fact this is the plan which will be adopted when the gigantic railway power stations now in course of construction in New York City are completed. But the rotary evidently introduces another transformation, which would be avoided by the employment of an alternating motor on the car; hence, while it appears that the problem is not a pressing one, in view of the present state of the art, every effort towards increased economy is to be encouraged. For that reason if for no other the efforts to apply the alternating motor direct to the car are to be commended.

The question of the storage battery in connection with electric railways is also bound to assume increased importance in the future. The installation of a number of large storage battery plants in the power houses and at outlying feeder ends of several prominent railways in the past is an indication that the utility of these storers and regulators of electric power is being gradually recognized, but thus far but a single road has been bold enough to operate with storage batteries on the cars themselves. The reports from this road are distinctly encouraging, and we are not at all so sure but that in time other roads may be similarly equipped where the conditions are favorable to that type of road. In contemplating the probable future of storage battery railroading we must not lose sight of the fact that it may be considerably influenced by the collateral progress in electrical vehicles; that type of conveyance must, and will, in time, evolve a distinct type of storage battery, and also methods of handling batteries that will unquestionably have a direct influence on the battery designed for the storage battery car.

For those who still object to the trolley paraphernalia within cities, the work accomplished during the last year in New York city must be cheering, indeed, and it is scarcely to be doubted that the underground conduit railway lines in New York city will have a marked influence on the future of electric railway work in the United States. This work, accomplished so thoroughly in such a remarkably short time, will be the pattern for much similar work in other cities. During the past year, also, every elevated railroad system in the United States, with the exception of one, has adopted electricity as its motive power, not only for reasons of convenience to its passengers, but owing to the still stronger demands of economy in operation. The only road which has not thus far adopted electricity is gradually losing its traffic, and will probably continue to do so until it adopts the new motive power.

We have touched on but a few of the topics which the members of the Street Railway Convention will probably find time to discuss at the Boston convention. The future of the elctric railway was never brighter than it is to-day, and with the growing knowledge of the best methods of conducting the business, together with the experience in handling existing apparatus, and the improvements which are bound to be made as time

Digitized by Google

passes, it would appear that no better or remunerative field of operation for the employment of capital can be found than in this method of transportation.

The Trolley and the Fan as Health Givers.

THE great mass of citizens are wont to look upon trolley lines as mere transporters of human freight, and the current as well as the trolley as things to be avoided, if possible. And this, regardless of the great strides made within recent years in electro-therapeutics and the invaluable benefits its promoters have conferred upon mankind. Who would underestimate the value of electro-dentistry or doubt for a moment the usefulness, nay, the indispensability of the Röntgen rays? Besides, the electric current is employed for the production of a large number of medicinal agents and the health of entire communities is insured by the disinfection of sewage by means of electricity. We might, continuing in this strain, mention in detail the healthful influence of the electric light and the various application of electricity for heating and power purposes.

Needless as it may appear to cite examples in support of the above, it may nevertheless be of interest to select from the panorama of our daily life those bright spots which reflect credit on the fresh-air work done by the electric fan and the "deadly" trolley.

Thus we might mention the case of a man prominently identified with the banking and street railroad business of Brooklyn, who had heard of the illness of a woman and her little one, and that there was little hope for the recovery of the mother. Instead of sending boxes of dainties, he had a wire run from the railway circuit near the house to the sick chamber and an electric fan placed at the foot of the invalid's bed. His fresh-air scheme reduced the patient's temperature in a short time and the physicians are of the opinion that it has much to do with the patient's improved condition.

As an antidote to the much abused trolley car we are gratified to see the following novel and beneficent uses made of it in various parts of the country. From Pittsburg comes the report of the growing use of trolley lines for fresh air outings. Listen to these words of a business man who says he has barely enough time to eat each day and is enthusiastic in his eulogy of the new condensed vacation trips: "I have been riding around since 8 o'clock this morning, and although I am feeling pretty tired now, it's a healthier feeling of tiredness than I leave the office with every day. I have been out in the open country in every direction from Pittsburg, and it has only cost me about $1.40. Besides I have breathed lots of fresh air, in an open car, and have seen bits of the country that surprised me. I am going to take these trips every time I get a few spare hours. People don't know how much good a series of trolley rides can do, if their time is limited, and they want the benefits of an outing."

A young physician, in a recent conversation, made the assertion that the number of children who actually owe their lives to the electric cars may be estimated by thousands. In support of this we quote his own words: "You can hardly calculate," said he, "the good that a ride into the country does a baby which is fairly prostrated with heat. It is possible to find along the lines of the electric railways places where the temperature is 20 degrees lower than in town. The cool, fresh breeze after a stifling hot day, in a close room in town, means a new lease of life for a child. I wonder that some fresh air society doesn't charter a car on some of the lines and reserve it in the evenings for mothers with sickly little children, letting them ride free. I don't know of any charity that would be cheaper and I don't know of any that would do more good here in Washington, where a five cent ticket puts within reach of everybody a luxury our grandfathers couldn't have had for a million dollars."

As to the extent to which this desire to get fresh air is carried it is encouraging to note the quick perception of our Philadelphia friends in the down-town districts who, instead of sleeping in their overheated homes at night or on the blistering brick pavements, are now spending their nights in an atmosphere more beneficial to their health. They now leave their homes at about ten o'clock at night, board a trolley car and in about an hour they have reached a spot in the Fox Chase woods where there is a difference of temperature of about ten degrees. Women and children go as well as men, and it is a novel sight to see hundreds of them camped about in the woods like so many traveling bands of gypsies. Their only baggage, however, is a pillow and a covering of some kind. Fox Chase is free from mosquitoes and other insects which generally make outdoor life uncomfortable in summer. After sleeping or resting in the woods for several hours they return to the city and engage in their day's labor.

The term "deadly" as applied to the trolley must soon be altered to "health giving" among the populace.

Dr. John Hopkinson, D. Sc., F. R. S.

THE brief announcement of Dr. John Hopkinson's death while attempting to ascend one of the Alps, must have come as a severe shock to the entire engineering world, but more particularly to the electrical engineer in every land. For by the death of Dr. Hopkinson one of the most prominent and earliest workers in the elctrical field has been removed from the scene of activity and a life resplendent with useful work and valuable contributions to science has been closed.

Dr. Hopkinson was born at Manchester in 1849, and was therefore only 49 years of age at the time of his death. He was educated at Owens College and Trinity College, Cambridge, from which latter place he was graduated in 1871 as Senior Wrangler. While an undergradute at Cambridge he graduated as doctor of science at London University. In 1872 he joined Messrs. Chames Bros. & Company's light house works at Birmingham as engineer and introduced many improvements, notable among which is the group flashing apparatus. It may safely be said that Dr. Hopkinson has designed a greater number of special forms of light house apparatus than anyone else, and with uniform success. After 1878 Dr. Hopkinson devoted a great deal of his leisure time to scientific research. His work in dynamo electric machines and subjects allied thereto, was begun in 1879. During his experiments with a Siemens machine he introduced the method of the characteristic curve. In 1883 he made the well known improvements on the Edison dynamo and was appointed lecturer at the Institution of Civil Engineers. During the next few years he worked out the theory of the dynamo machine on a thoroughly satisfactory basis, which he published in conjunction with his brother, Dr. E. Hopkinson. This method of predetermination in dynamo design has become standard.

Dr. Hopkinson was elected a fellow of the Royal Society in 1878. He was a member of the Senate of London University, of the council of the Institution of Civil Engineers and Mechanical Engineers, and was president of the Institution of Electrical Engineers in 1890. In this year he also received one of the medals of the Royal Society. In 1895 he again accepted the presidency of the Institution of Electrical Engineers. Besides his scientific researches Dr. Hopkinson had found time to design several large electric lighting installations principal among which should be mentioned the very successful stations at Manchester and Whitehaven. He also designed electric railway systems for the Corporation of Leeds, as well as those of Liverpool and St. Helens. He did besides a vast amount of consulting engineering, all of which has turned out as successful as every labor with which Dr. Hopkinson was connected. Dr. Hopkinson's memory will be cherished by a large number of friends on this side of the Atlantic.

War Inventions.

WAR has its humorous, as well as its serious aspects. Among the former none have proved more diverting than the schemes evolved by ambitious inventors to wipe the enemy off the face of the earth. One of the latest of the frightful engines of destruction put forward is that of Dr. S. F. Emmens, of "Emmensite" fame. This gentleman proposes to build an electric gun consisting of a series of solenoids, which are successively energized and through which the projectile loaded with high explosives is sucked at an increasing velocity. One of the daily papers represents this fearful and wonderful gun mounted on a long railway carriage with the destroying projectile emerging from the last solenoid, apparently bent on frightful destruction. We think it is hardly necessary to go into the calculation of the size and number of the solenoids required to give the projectile velocity sufficient to permit it to cover a given range, but a slight contemplation of the subject will at once indicate its utter impracticability. Besides long before Dr. Emmens conceived the idea, others had hit upon it, and, indeed, we know as a matter of fact that such a gun was actually constructed on a small scale nearly twenty years ago.

Digitized by Google

TELEPHONY AND TELEGRAPHY

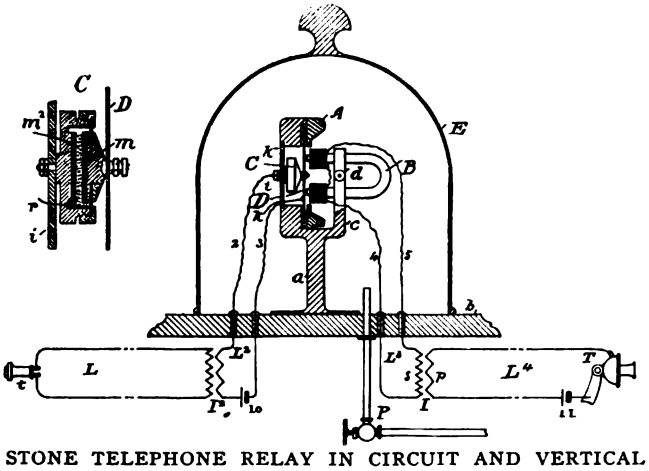
The Stone Telephone Repeater.

A patent has recently been issued to Mr. John S. Stone, of Boston, Mass., on a telephone repeater or relay, which embodies novel and ingenious features. It belongs to that class of apparatus in which are combined in a single instrument the variable pressure contacts of a microphone transmitter, the electromagnet of a magneto receiver, and a diaphragm or vibratory plate, these being so arranged that in operation the diaphragm shall vibrate in response to the talking currents traversing one telephone circuit and manifesting themselves in the action of the receiving magnet and shall communicate its vibrations to the transmitting contacts, producing thereby similar talking currents in a second telephone circuit, with which the transmitting contacts are connected.

Mr. Stone's relay is adapted to be placed at the junction of two telephone circuits extending from different terminal stations for the purpose of automatically repeating the conversation transmitted over one circuit into the other and consists of a telephone receiving or repeating magnet in one circuit, transmitting electrodes or microphonic contacts in another circuit, a diaphragm common to the magnet and transmitting electrodes placed in operative relation to both, so as to act as a receiving diaphragm for one circuit and a transmitting diaphragm for the other, and a vacuum chamber or exhausted receiver inclosing the receiving magnet, transmitting electrodes, and diaphragm.

Referring to the figures, B is an electro magnet whose poles are in proximity to the diaphragm referred to further on.

C is the button of a variable resistance transmitter containing



STONE TELEPHONE RELAY IN CIRCUIT AND VERTICAL SECTION OF TRANSMITTER BUTTON.

the transmitting electrodes—in this instance two plates m m², with granulated carbon r between them, the plate m being secured to the diaphragm and vibrating with it and the plate m² being rigidly secured to the frame or back plate; D, the common diaphragm, and E the vacuum chamber. The magnet, electrodes, and diaphragm are inclosed in the vacuum chamber, and the whole is mounted on a base b.

The support a, secured to the base b, has an opening through its upper part, provided on one side with a shoulder or offset forming a seat for the diaphragm, which is held in place by the cap-piece A, or in any preferred manner. The transmitting button placed in the opening is attached on one side to the centre of the diaphragm D and and on the other side to the plate or bar i, which, if of such shape as to close the opening, is perforated with the holes k, so that the atmosphere on both sides of the diaphragm shall be of the same density.

The receiving or repeating magnet B is mounted upon an arm c of the support a, being adjustably clamped to it by a screw d, and its poles are brought into proximity to the outer face of the diaphragm, which is thus placed between the magnet and the transmitting electrodes.

The exciting coils of the magnet B are connected with the conductors 4 and 5, which form the instrument portion of a telephone circuit extending either directly or inductively by means of the induction coil I and two circuit sections L³ L⁴ from a subscriber's transmitter T. In the latter case 11 is the transmitter battery, p is the primary helix of the induction coil in the circuit section L⁴, and s is the secondary helix, placed in the circuit section L³. The transmitting electrodes C are similarly connected by means of the conductors 2 3 in a second telephone circuit L², which extends to the receiving telephone t, this circuit also being shown as having two sections L² and L united by an induction coil I².

The vacuum chamber or exhaust receiver E may be of glass, and since in the normal operation of the relay it is required that the transmitting electrodes and diaphragm shall be surrounded by a rare medium less dense than air at atmospheric pressures a pipe P passes through the base b to connect with an air exhausting pump (not shown) for the purpose of producing a vacuum or of rarefying the air within the chamber E to the degree required. The passages through which the electrical connection wires 2, 3, 4, and 5 and the exhaust pipe p enter the chamber E are of course sealed, packed, or otherwise made air tight.

To more perfectly attain the desired result of highly efficient relayed transmission, the diaphragm D may be balanced or subjected to like normal attractive strain in both directions, This may be accomplished by employing two receiving magnets, mounted on the two sides, respectively, of the diaphragm on the supporting arms. The coils of these magnets are placed in the same circuit and are so relatively connected up that the same current impulse which strengthens the attraction exercised by one of the magnets upon the diaphragm shall weaken that of the other, so that the two magnets will uniformly work together, each aiding the other in producing all of the appropriate diaphragm vibrations. When two magnets are employed in this way, it is convenient to associate with the diaphragm two soft iron armatures, one for each magnet, these being mechanically united to one another by light metal rods and by another rod to the diaphragm.

The Telegraph in Porto Rico.

The War Department has received advices from Porto Rico on the work being done by the little army of Signal Service men on the island. There are 300 of these men now there, and they will have to assume the control and operation of the Government lines of telegraph. The lines now, of course, are operated by Spaniards, but when the possession of the island is transferred to the United States the Signal Service will have to take charge until the future status of the system is determined.

The Government has always been opposed to a governmental telegraph system, and Signal Service officials say it is not improbable that the lines in the new island possession will be eventually sold through bids for its purchase. This, however, has not yet been considered officially, and governmental control will have to be assumed, at least until the ultimate disposition is determined, at all the offices on the entire telegraph system of Porto Rico.

Blue-print diagrams of the system have been forwarded to the Signal Service authorities. They show that, aside from a line that runs irregularly along the coast, there are two lines running directly north and south, and others forming a network through the island. The principal telegraph stations which the Signal Service will have to man are at San Juan, from which there is also a double line to Caguas; Ponce, from which there is also a double line to the shore; Mayaguez, Yauco. Guayama, Arroyo, Hemacao, Farjado, Aguadilla, Arecibo, Utuardo, Rio Piedras, Cayey, Aibonito and Ciates.

While there is much work to be done in the way of extending and operating the telegraph lines in the newly acquired possessions, Signal Service officials say there is no difficulty in securing enough men. Of the 300 men now in Cuba, it is claimed two companies could be withdrawn for other fields without detriment. A number of the volunteers in the corps have asked to be discharged, and where their requests are well founded they will be complied with.

Colonel Allen, Chief Signal Officer on General Miles' staff, who has been in charge of the Signal Service work in Porto Rico, has wired that he will sail from Ponce for the United

Digitized by Google

States. He is in poor health and is coming back to recuperate. Lieut. Col. Glassford, next in rank, will take command of the Signal Corps on the island.

Municipal Telephony in England.

It is stated that the select committee on the telephone service in Great Britain have agreed by a majority to recommend that the post-office shall grant licenses to municipalities on the same terms as it does to the National Telephone Company—that is to say, 10 per cent. of the rentals charged to customers.

Some Recent X-Ray Work.

The following items appear in "Science Abstracts," published by the Institution of Electrical Engineers and the Physical Society, London.

CATHODE RAYS. E. Wiedemann and G. C. Schmidt. Cathode rays are usually present in two different forms; first, the ordinary slightly conical beam forming a solid cone of rays, and secondly the beam diverging from about the same point as the other, but in the form of a conical mantel forming rings or ovals where it meets the tube. The authors have here investigated the cause of the latter and the influences which regulate its form. Its cause is attributed to rapid oscillatory discharges; and in the experiments the authors used tubes without electrodes, and excited discharges in them by means of a Lecher system of wires. The electrodes consisted of balls or rings pressed against the outside of the tube. The angle of the cone of rays diminishes with the curvature of the glass, increases rapidly with the curvature of the electrode, and increases rapidly with diminution of pressure of gas. The authors suggest the following explanation of these and all similar phenomena:

1. Rapid oscillatory discharges in rarefied gases take place near the surface as in metal conductors, but in gases are prevented from reaching the surface by the walls of the tube acting as a cathode, the discharge being thus separated from the walls by a dark cathode space.

2. The cathode rays leave the surface between the solid and the gas in the direction in which the oscillatory discharge is penetrating that surface. In air at atmospheric pressure the direction in which the oscillations leave a conductor is perpendicular to the surface of the conductor, so that if a metallic sphere is laid against the tube the cathode rays start perpendicular to the surface of the sphere. The angle of the cone only reaches a certain magnitude, owing to the distance between the sphere and the gas in the tube being too great beyond that angle. This critical distance is attained at a smaller angle the greater the curvature of the sphere.

If the metal is surrounded by rarefied gas, as is the case with internal electrodes, then the dark space influences the direction in which the oscillations leave the cathode and cause it to be no longer perpendicular to the surface.

ELECTROSTATIC PROPERTIES OF CATHODE RAYS. P. Lenard. Experiments carried out on the lines of those made by J. J. Thomson and W. Wien, lead to the result that cathode rays behave in every respect as if they consisted of moving particles possessed of inertia and conveying negative electric charges. Cathode rays emerging through a "window" and entering an observation-space is a perfect insulator. When a field is created between two condenser-plates in the observation-space, the rays are bent towards the positive plate. Those rays which suffer the strongest magnetic deflection also undergo the strongest electric deflection. The velocities of the various rays differ a little. They are probably about one-third of the velocity of light.

NODES IN CATHODE RAYS. E. Wiedemann and A. Wehnelt. When a magnet is placed opposite the cathode of a vacuum tube, or the latter is enclosed in a solenoid, the lines of force are parallel with the rays, and the latter are twisted into a succession of loops or segments which bear some resemblance to those of a vibrating string. The phenomenon may be fully explained by the projected-particle theory of cathode rays. The feebler the field, and the higher the velocity of projection (i. e., the potential and the exhaustion), the longer are the corresponding segments. The glow-light is not similarly affected.

VISIBILITY OF ROENTGEN RAYS. E. Dorn. That the light effect of Röntgen rays is not due to an act of "accommodation" as has been alleged, has been proved by the author with the aid of a medical friend, who intentionally paralyzed the accommodation capacity of one of his eyes with homatropine, and found the visual effect as strong as before. The fact that a straight rod sometimes casts a bent shadow into the eye is explained by considering that Röntgen rays are not refracted by the humors of the eye. The rods therefore cast straight lines on the retina, which are ordinarily only produced by bodies bent in a certain manner. The straight lines are therefore interpreted as being due to bent rods.

URANITE RAYS. E. Villari. The paper describes experiments on the property possessed by uranite of discharging electrified bodies. The electrified body was a gold-leaf electroscope, which lost from leakage 1 deg. in 90 seconds. On placing a piece of uranite 1 cm. from the electroscope-knob the loss was 1 deg. in 7 seconds. Sending a current of air transversely between the knob and the uranite slightly reduced the loss to 1 deg. in 8 seconds. To ascertain to what extent the discharging power persists, the uranite was placed in a tube 20 cm. from the electroscope. This lost 1 deg. in 24 seconds when a current of air or of illuminating gas was directed through the tube against the electroscope knob. Increasing the distance to 190 cm., the loss was 1 deg. in 54 seconds. The loss without the uranite was 1 deg. in 148 seconds. Further the author found that when a metal point was placed in the air current, the phenomena were the same as in the case of gas subjected to Röntgen rays. Without the uranite and with the point to earth, the loss was 1 deg. in 134 seconds; with the uranite, 1 deg. in 25 seconds. With electroscope and point charged to opposite potentials, 1 deg. in 43 seconds; to similar potentials, 1 deg. in 156 seconds. If, however, the charged point were close to the end of the tube and nearly equal in size to its diameter, the discharging power was entirely lost. When the uranite was closed in a paper envelope no action was observable, though an image was obtained on a sensitive plate through black paper after an exposure of twenty-four hours.

Apparatus for Illustrating Change of Phase Produced by Inductance or Capacity.[1]

BY SIDNEY T. MORLAND.

THE apparatus consists of a divided circuit having in each branch a conductor arranged to vibrate freely and with delicate means of adjusting its tension. This conductor is stretched between the poles of a strong magnet. The tension is so adjusted as to make the period of vibration of the conductor agree with the period of the alternating current which traverses the conductor; under these circumstances the conductor vibrates. A small mirror is attached to one end of each of the stretched conductors, and these conductors are placed at right angles to each other in such position that a small beam of light is reflected successively from the two mirrors, one of the conductors being horizontal and the other vertical. We suppose the beam of light to be received directly by the eye after reflection by the last mirror.

Now, if only one conductor be allowed to vibrate, say the horizontal one, the eye will see a horizontal band of light instead of a spot; if only the vertical conductor be allowed to vibrate the eye will see a vertical band of light; if the two vibrate at the same time, and if the two branched circuits are exactly alike in all respects, the eye will see a straight band of light lying between the horizontal and the vertical position; that is, the resultant vibration is a straight line.

[1]Read before the A. A. A. S. Abstract.

Digitized by Google

Now, if a coil of wire having an iron core is introduced into one branch of the circuit and not in the other, theory shows that the phase of this branch will lag behind the other and that the resultant vibration will now be not a straight line, but an ellipse. The apparatus shows the ellipse. If a condenser is substituted for the coil the apparatus again confirms the theory in showing an ellipse. Theory also shows that, whereas, the coil causes the conductor to lag behind, the condenser causes it to advance ahead of the other conductor. In other words, if the complete ellipse is made in one case by a spot of light circulating in the direction of the hands of a watch, in the other case it is made by a spot circulating in the opposite direction. In order to show whether this is the case the beam of light is made to pass first through a small hole and then through a slit attached to a prong of a tuning fork in such a way that when the fork is vibrating the light can only fall on the mirrors when the fork is passing the position of rest; in other words, the light is regularly intermittent.

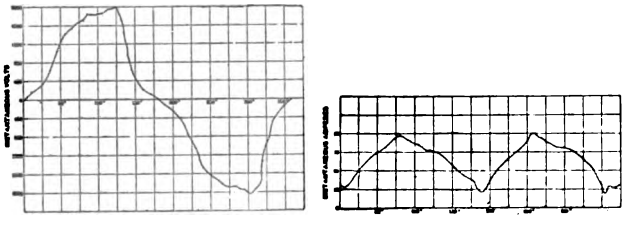
By means of sliding weights on the prongs of the fork its time of vibration can be adjusted so as to make exactly one vibration while the conductors make two. Instead of seeing a complete ellipse the eye now sees an arc which is stationary. If the time of vibration of the fork be very slightly increased the arc will move around slowly in the direction in which the spot actually travels.

Having made this adjustment and having observed the direction in which the arc travels, if the condenser be substituted for the coil it will be observed that the direction in which the arc travels is changed. Thus the apparatus shows that either an induction coil or a condenser will cause a change of phase, and that these changes are in opposite directions.

The Commutated Current Wave of a Composite Wound Alternator.[1]

BY PROF. D. C. JACKSON.

THE accompanying curves were taken by Mr. H. S. Webb, one of my graduate students, during a relative study of the current and pressure waves in the various branches of a 50 kilowatt alternator with composite winding. The normal pressure of the alternator is 1,100 volts, and the frequency is 125 periods per second. The machine was built several years ago by the Thomson-Houston Electric Co., and has the usual construction of the old belt-driven alternators with ten field poles and a toothed core, ribbon-wound armature. The driving speed during the tests was quite unsteady, as the machine was driven by the same engine that drove two street railway generators: and this resulted in irregularities which are evident in the curves.



FIGS. 1 AND 2.—PRESSURE AND COMMUTATED CURRENT WAVES WITH LOAD OF 22 AMPERES.

I am not acquainted with any results which have heretofore been given in the Transactions of the Institute or elsewhere, which show the characteristic form of the commutated current waves in the series field of an alternator, and I therefore present these curves. The question of the form of the commutated current wave is mentioned in two or three text books, but experimentally determined waves do not appear.

In the series of curves presented herewith, Fig. 1 is the pressure wave when the armature current equalled 22 amperes. A comparison of Fig. 2 shows the wave of commutated current in the series field when the external current equalled 22 amperes.

A comparison of the external current waves, with the commutated waves, shows that the commutated waves have practically the same form as the original waves of current (with alternate loops inverted) except in regions occupying about 25 degrees on either side of the zero points of the original waves. Within these regions the commutated waves do not come to zero and they take a characteristic toothed shape, as is to be expected from the effect of the self-induction of the field windings when they are short-circuited by the brushes on the commutator. There does not appear to be any immediate connection in this machine between the pulsations of the series field current and of the current in the separately excited field. The latter pulsations are, in fact, sufficiently accounted for through the effect of the rotation of the toothed armature and the effect of armature reactions.

The points on these curves were located by a balance or potentiometer method similar to that described on pages 296 and 297 of Jackson's "Alternating Currents," but, instead of the usual galvanometer or telephone receiver, Mr. Burgess' portable form of capillary electrometer recently described was used to indicate the point of balance. This instrument has been used in tracing alternating current curves by quite a number of my students, and it is the unanimous verdict that the instrument greatly increases the convenience, the accuracy, and the speed of the method. We have had a number of the instruments in use during the past winter and have found them perfectly portable, difficult to injure, and practically unaffected by external influences.

[1]Read before the A. I. E. E. Abstract.

Capt. Robert Edwards, Jr.

We are pleased to note the fact that on August 20 Messrs. Edwards & Co., manufacturers of electrical goods, 144th street, New York, have learned from Capt. Robert Edwards, Jr., that Company B, Eighth New York Volunteers, now at Chickamauga Park, has enjoyed good health in camp from the beginning. Of the 104 men in his company, we deplore the fact that 59 are on the sick list, over 35 of them having typhoid or cerebral meningitis, and should the Eighth be compelled to make the march through Georgia, as ordered, it is thought that hardly more than 25 could comply with the orders. Capt. Edwards' wife has been near the camp all summer.

SOCIETY & CLUB NOTES

Meeting of the N. Y. State Street Railway Association.

The annual meeting of this association will be held at Manhattan Beach, Coney Island, N. Y., on Sept. 13 and 14. A number of interesting papers have already been submitted and the topical discussions promise to elicit much useful information.

Association of Edison Illuminating Companies.

The annual meeting of this association will be held at Sault Ste. Marie on Sept. 11, 12 and 13. Quite a number of the members will leave Buffalo on the steamer "North West" on Sept. 9, and make the lake trip to the Sault. Headquarters will be at the Iroquois Hotel.

Eighth Annual Meeting of the American Electro-Therapeutic Association.

The eighth annual meeting of the American Electro-Therapeutic Association will be held in Buffalo on the 13th, 14th and 15th of September. The business meetings of the association will be held in the rooms of the Buffalo Society of Natural Sciences, in the Public Library Building. Among the papers to be presented are some by the most noted writers on medical topics in this country and Europe, among which might be mentioned Drs. Apostoli and Gautier, of Paris, Dr. La Torre, of Rome; Dr. J. I. Parsons, of London; Mr. Nikola Tesla, of New York, and a number of others of equal prominence. The papers embrace the entire field of electro-therapeutics and will make the convention of great interest and value. A public exhibition of electrical apparatus for diagnostic, radiographic and therapeutic work will be held in the library, and a large number of enter-

Digitized by Google

tainments have been provided for. Special hotel rates have been secured at Niagara Falls as well as in Buffalo for all attending the convention.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued August 23, 1898.

Alarms and Signals:—

BURGLAR ALARM. D. L. Wartzenluft, Kutztown, Pa., 609,640. Filed Nov. 16, 1897. Comprises an electric circuit, the wires of which are extended across a window, an alarm in the circuit, and a circuit closer mounted to swing on one of the wires and adapted to close the circuit when swung out of its normal engagement with the window.

APPARATUS FOR SIGNALING ON LOCOMOTIVES. F. A. Cheetham, Rastrick, and R. Bostock, Brighouse, England, 609,732. Filed Jan. 18, 1898. Details of construction.

Electro-Metallurgy:—

ALLOY OF IRON AND TITANIUM AND PROCESS OF PRODUCING IT. A. J. Rossi, New York, 609,466. Filed June 5, 1895. A compound containing not less than 10 per cent. of iron, some carbon, and titanium in proportions of not less than 5 per cent.

PROCESS OF MANUFACTURING ALLOYS OF TITANIUM. A. J. Rossi, New York, 609,467. Filed Oct. 16, 1897. Similar to above.

Electro-Therapeutics:—

ELECTRICAL APPLIANCE FOR ASSISTING ANATOMICAL ORGANS. J. Doty, Syracuse, N. Y., 609,914. Filed March 22, 1898. Details of construction.

ELECTRO-MEDICAL APPARATUS. R. H. Wappler, New York, 609,639. Filed Nov. 2, 1897. Comprises a rheostat coil, two sliders, a shaft, cranks and connections for moving the sliders in opposite directions, a hand upon the crank shaft and a dial for indicating the action of the rheostat in the electric circuit.

Lamps and Appurtenances:—

DEVICE FOR ATTACHING AND DETACHING ELECTRIC LAMP BULBS. C. G. Edwards, Albert Lea, Minn., 609,421. Filed Aug. 23, 1898. Consists of a rotatable handle, a holder for engaging with the bulb and connecting with the handle, and a guard extending out from the handle.

Miscellaneous:—

FIELD-SPOOL-WINDING MACHINE. W. Leist, Norwood, O., 609,620. Filed Aug. 14, 1897. Comprises a support, two parts mounted on the support, namely, a rotatively mounted frame provided with means for removably supporting a supply spool and a carriage having means for moving one of the parts relatively to the other part in a direction parallel to the axis of rotation of the frame.

MANUFACTURE OF FLUID FOR IMPREGNATING FIBERS FOR INCANDESCENT LIGHTING. G. B. Puchmüller, Schöneberg, Germany, 609,702. Filed March 21, 1898. Employs a fluid consisting of oxids of strontium, zirconium, barium and aluminum.

DIAPHRAGM FOR ELECTROLYTIC PURPOSES. W. G. Luxton, Liverpool, England, 609,745. Filed April 9, 1898. A composition of cement, sand and a porous material mixed with water and allowed to dry, the diaphragm having pores through the substance of the porous material and interstices between the cement and other constituent particles.

Classified Digest of U. S. Electrical Patents Issued August 30, 1898.

Conductors, Conduits and Insulators:—

CLAMP FOR ELECTRIC WIRES. S. S. Leonard, Chicago, Ill., 609,888. Filed Jan. 24, 1898. A clamp consisting of a flexible loop adapted to embrace the glass insulator and a pair of clamping blocks loosely secured to the loop at one end and each provided at the other end with a notch adapted to receive the free end of the wire, that end being provided with means for clamping it upon the blocks.

Dynamos and Motors:—

ALTERNATING CURRENT MOTOR. C. S. Bradley, Avon, N. Y., 610,025. Filed Sept. 17, 1897. Includes a primary winding provided with a plurality of branches, including inductance to set up in the primary core a rotary field when connection is made with a single-phase current, and a secondary element, the windings of which are connected with an adjustable phase leading device.

INDUCTION MOTOR. B. G. Lamme, Pittsburg, Pa., 610,067. Filed July 22, 1897. Embodies a secondary member, comprising a spider, a laminated slotted core, bar conductors located in the core slots and projecting beyond the ends of the same, and resistance rings provided with ventilating and centering blades which are bolted to the inner sides of the projecting ends of the bar conductors, and have shoulders bearing against the adjacent portion of the spider.

Electro-Metallurgy:—

PROCESS OF EXTRACTING METALS FROM METALLIC OXIDS. H. C. Aschermann, Cassel, Germany, 610,014. Filed April 20, 1897. Consists in adding to such oxides the sulfide of antimony in greater proportions than the oxides, and then subjecting the mixture to electric currents.

Electro-Therapeutics:

ELECTRODE FOR MEDICAL PURPOSES. M. N. Clarke, Wilkesbarre, Pa., 609,875. Filed Jan. 8, 1898. A suitable source of electricity and a pair of electrodes, consisting of metal plates filled with small perforations.

Lamps and Appurtenances:—

HANGER FOR ELECTRIC LAMPS. W. F. Murphy, Iowa City, Ia., 609,972. Filed Dec. 21, 1897. Details of construction.

Miscellaneous:—

PROCESS OF AND APPARATUS FOR PRODUCING CALCIUM CARBID. M. P. Wood, New York, 609,864. Filed April 23, 1897. Consists of forming a mixture of the pulverized mineral and carbon with a suitable binder into a cartridge; subjecting the cartridge to the direct heat of a combustion-furnace and passing an electric current through the cartridge while still subjected to the heat of the furnace.

Railways and Appliances:—

ELECTRIC LOCOMOTION. H. Van Hoevenbergh, New York, 609,851. Filed Oct. 10, 1895. A trolley having spring-pressed contacts, and conductors for connecting with a vehicle, the conductors being mounted on the frame by a laterally movable connection.

TROLLEY. D. Lippy, Mansfield, O., 609,969. Filed Feb. 23, 1898. Details of construction.

ELECTRIC RAILWAY MOTOR. A. Schmid, Pittsburg, Pa., 609,977. Filed May 10, 1894. Comprises an armature, a field magnet constructed in two sections, the upper section being supported by the car truck and the lower section being hinged to and supported by the upper section and adapted to swing downward.

RAIL BOND. W. H. Talley, Waco, Tex., 610,004. Filed Nov. 26, 1897. Comprises a suitable rail having a base angle bar located on either side and having basal flanges, normally in contact with the base of the rail, angular-shaped grooves formed in the basal flanges of the angle bars, and triangular conducting bars located in the grooves.

CONTACT DEVICE FOR ELECTRIC RAILWAYS. L. W. Walkins, Springfield, Mass., 610,007. Filed Jan. 24, 1898. Underground conduit system embodying roller contacts.

CONTACT RAIL APPLIANCE FOR ELECTRIC RAILWAYS. L. E. Walkins, Springfield, Mass., 610,008. Filed Feb. 2, 1898. Similar to above.

ELECTRIC RAILWAY. L. E. Walkins, Springfield, Mass., 610,009. Filed Feb. 2, 1898. Similar to above.

ELECTRIC RAIL BOND. B. C. Seaton, St. Louis Mo., 610,090. Filed April 5, 1897. The conductor is carried between the rails by an insulating support and housing, composed of two members arranged one above the other, and suitably fastened together, the conductor being clamped between the two members.

THIRD RAIL FOR ELECTRIC RAILWAYS. B. C. Seaton, St. Louis, Mo., 610,091. Filed Dec. 7, 1897. The rail is formed with a channel in the upper side to receive feed-in wires.

CONTACT DEVICE FOR ELECTRIC RAILWAYS. B. C. Seaton, St. Louis, Mo., 610,092. Filed Feb. 4, 1898. The combination comprises a hanger having a head secured to it, a frame pivoted to the head, a shoe secured to the frame, and a spring for holding the frame in a horizontal position.

THIRD RAIL FOR ELECTRIC RAILWAYS. B. C. Seaton, St. Louis, Mo., 610,093. Filed Feb. 4, 1898. Comprises a conductor having a vertical flange providing an exposed surface for the contact shoes and a lateral flange, providing a guard for the contact shoes.

ELECTRIC RAILWAY. B. C. Seaton, St. Louis, Mo., 610,094. Filed Feb. 18, 1898. Comprises a third rail in combination with a crossing located in a gap in the third rail and consisting of a hood, bars supporting the hood, and a conduit enclosed by the hood and bars.

Regulation:—

MEANS FOR CONTROLLING NON-SYNCHRONOUS ALTERNATING MOTORS. B. G. Lamme, Pittsburg, Pa., 609,990. Filed March 11, 1898. A variable speed, non-synchronous motor having a comparatively large secondary resistance and a small degree of magnetic leakage between its primary and secondary members, and means for varying the electromotive force applied to its primary member, whereby the speed of the motor is varied.

METHOD AND MEANS FOR SECURING CONSTANT TORQUE IN POLYPHASE MOTORS. B. G. Lamme, Pittsburg, Pa., 609,991. Filed Feb. 10, 1898. An induction polyphase motor having a comparatively high resistance secondary winding and small magnetic leakage combined with choke coils in the external circuit, the cores of which become saturated by a given current whereby a constant torque is secured.

Switches, Cut-Outs, Rheostats, Etc.:—

CONTROLLING DEVICE. K. A. B. D. Kottgen, Charlottenburg, Germany, 610,064. Filed Dec. 30, 1897. Designed for the operation of hoists. Details of construction.

CONTROLLER FOR ELECTRIC MOTORS. H. P. Davis, Pittsburg, Pa., 610,124. Filed April 25, 1898. In a controller for electric motors, the combination comprises a resistance-varying switch, and a series-parallel switch, the shafts of the switches being at right angles to each other; gearing between the shafts, combined cut-out and reversing switches and interlocking mechanism.

ELECTRIC CIRCUIT CONTROLLER. J. H. Bowley, Washington, D. C., 11,689. Reissued. Filed Nov. 9, 1897. Means for the control of atmospheric conditions in food-storing chambers.

Telephones:—

TENSION REGULATOR FOR ELECTRICAL TRANSMISSION OF SPEECH. A. C. Cousens, Newark, N. J., 609,877. Filed June 15, 1895. Consists in subjecting to the action of the transmitting current, a substance from which is thereby generated, a gaseous variable resistance medium, and varying the resistance of the gaseous medium by the action of and to conform to the sound waves to be transmitted.

AUTOMATIC CUT-OUT FOR MAGNETO GENERATORS. W. J. Bowen and C. A. Federer, Cleveland, O., 610,023. Filed May 26, 1898. Consists of a spindle carrying a loose wheel and an insulating projection rigidly secured to the spindle, a pin-and-slot connection between the wheel and projection, a contact plate on one of these parts, and a spring arranged to hold the pin in contact with the plate.

Theft of Current at Erie, Pa.

The "Erie Dispatch" says: "A warrant issued by Alderman McAndrew has been served on Leo Gieringer, of 1712 Peach street, at the instance of the Edison Electric Light Company, whereby that party is cited to appear on a criminal charge, the offence being nothing more nor less than the alleged stealing of lightning. The information charges that Gieringer, who is a confectioner, has attached a wire to the Edison Company's feed wire which passes his place and that he has been running a motor for a year or more, to say the least, surreptitiously, that is, without the knowledge of the prosecuting company, and has been using the current generated and sold by the Edison people. The allegation is that Gieringer has been running a fan to cool the fevered brows of his customers."

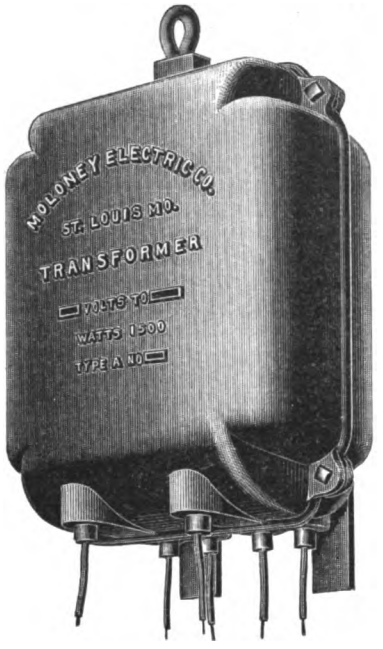
Digitized by Google

TRADE NOTES AND NOVELTIES

The Moloney Electric Company's Type A Transformers.

THE need of greater economy in alternating current distribution is being daily pressed upon the attention of those in charge of central stations. Within the past few years the importance of increased operating efficiency in transformers has become plainly evident to them, and a closer investigation of existing systems and apparatus has been generally instituted.

A company who have constantly endeavored to promote the spirit of inquiry is the Moloney Electric Company, located at No. 6 North Twelfth street, St. Louis, Mo., who have placed on



MOLONEY ELECTRIC CO.'S TYPE A TRANSFORMER.

the market a thoroughly up-to-date transformer covering every desirable feature of economic distribution which experience has thus far suggested in the construction of transformers. Their claims of merits have been amply borne out by severe tests to which the transformers have been subjected. The following is a description of the company's Type A transformer and the advantages claimed for it:

In the company's Type A transformer the core and copper losses have been reduced and the maximum all-day efficiency has been greatly increased. Close regulation is a salient feature of the Type A transformer. Regulation depends on the copper loss and magnetic leakage. Copper loss is reduced by lessening the resistance of the coil, which is done by using a wire comparatively large for the current it has to carry. But to diminish the effect of magnetic leakage is more difficult of accomplishment. In the Type A transformer, however, by the peculiar construction of the core and windings, this effect is practically nullified. In fact, so insignificant is the magnetic leakage in this transformer that it is hardly discernible under the severest test, and as to the C^2R loss, it has been reduced to a point which long practice and experience have demonstrated to be the most efficient for all practical purposes.

Sometimes a transformer of very low resistance is in requisition for special laboratory work. In such cases the company will construct "special" transformers to meet the specifications given.

Alternating current circulating in the coils, the wires are attracted and repelled at a rate of about 100 times to the second. This ceaseless attraction and repulsion of the wire soon pulverizes the insulation, and the turns of the coil come in contact; injury to the apparatus follows where the coils are wound loosely with a packing of some insulating material.

How to remedy this condition of affairs has been a leading consideration in the construction and designing of the company's transformer, and they claim to have successfully attained their purpose: (1) By compressing the cores under very high pressure, which is made possible by their construction, (2) by winding the wire on the coil under very high tension, (3) by using only the very best insulation. In this way they have shut off all possibility of vibration either in the wires or the iron, a proof of which is the absence in these transformers of that sizzing sound that betokens the deteriorating effects of vibration.

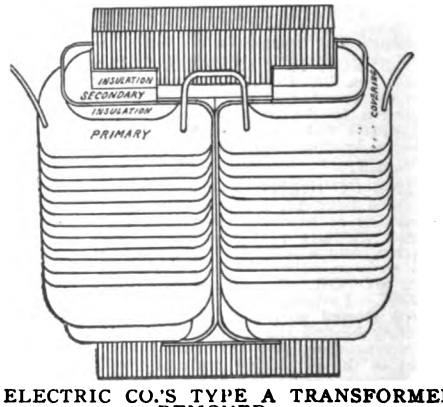
A very necessary requirement in transformer insulation is the unchanging durability of the substance to be employed. Oil has been freely advocated. Experiments with oil made by the company have proved it to be a very unsatisfactory insulating medium. They are not, however, wholly against the use of oil as an insulator. On the contrary, they are of the belief that in transformers of lower voltage it may be used to advantage, provided the supply is renewed every six months or so. But these, of course, are not conditions to be expected in general practice.

Their experiments with cloth (oil cloth, linen, etc.) and paper have convinced them that these are not materials to be used in first-class transformers, as they deteriorate with age. The company's patent insulation has been so devised as to withstand the effects of a very high temperature and the vicissitudes of age, whether in actual use in the transformer or on the shelves of their storerooms.

The case of this transformer has been made with a view to convenience as well as safety. The eye-bolt on the top exactly in the centre makes it easy to raise, while the terminals on the buttons prevent short-circuitings in the bushings and facilitate connection.

Lost energy in a transformer manifests itself by the presence of heat, for the radiation of which some disposition must needs be made. The Type A transformer has been so constructed that most energy is lost on the outer surface, whence the heat is easily dispelled through the ventilating slots. This construction has the result that there is comparatively little increase in temperature while the transformer is under full load or even under a considerable overload, a feature characteristic of the Type A transformer.

All iron is liable to deterioration, but in the finer kinds the process of ageing is so slow that it can be perceived with difficulty. After repeated tests, in which the company spared neither effort nor money, they have succeeded in securing for the manufacture of their transformers an iron, in which even after a constant use of eighteen months, scarcely a trace of this degeneracy is discernible. In this respect, as in all others, they are ready to guarantee Type A transformer for a term of two years.



MOLONEY ELECTRIC CO.'S TYPE A TRANSFORMER.—COVER REMOVED.

They have designed a "lightning arrester" to protect the circuits on which their transformer is used, and have never hesitated to guarantee their customers against damage by lightning where the line is safeguarded by this or any other approved pattern of arrester.

The company have amply provided for emergencies, so constructing their transformers that they will bear an overload of from 25 per cent. to 30 per cent. for an indefinite length of time. To this point they call attention in their contract, and offer an especial guarantee for the fulfillment of this condition. All transformers are interchangeable for 1,000 to 2,000 volt primary.

Digitized by Google

Work in central stations may sometimes, from its very nature, require a special design of transformer. The company manufacture all such specialties. Series transformers, for series incandescent and arc lighting, "step-up and step-down" transformers, test transformers, etc.

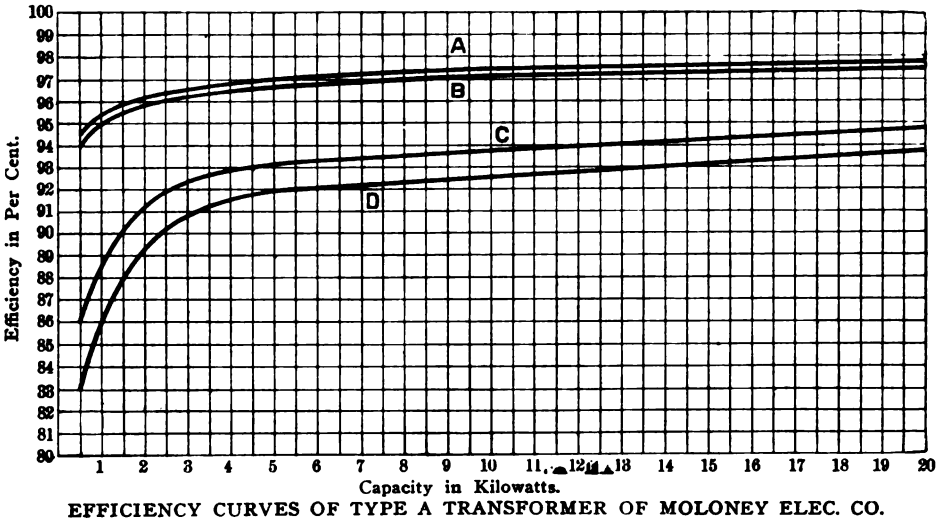
The test transformer consists of one subdivided transformer (step-up) from 1,000 to 10,000 volts, and one subdivided regulating transformer of 100 to 200 volts.

They will turn out these apparatuses in conformity with any given specifications. In cases where extraordinary precaution is required to insure against the connection of the primary and secondary windings, they furnish the "Ground Shield" transformer. This shield is a simple tegument of copper, which completely envelops the secondary coil and from which it is thoroughly insulated as well as from the primary. It is grounded so that any rupture in the insulation of the primary coil will connect it with the earth, thus protecting the secondary from the high-tension current of the primary. This model is not intended for general use and is recommended only in cases where such extra precaution is advisable.

The company also manufacture arc light Type B transformers, which they always carry in full stock and of all sizes and voltages.

These transformers are of the same high grade as Type A, and are subjected in their manufacture to the same rigid tests as a guarantee of their superior efficiency and durability. They are set up in either ornamental or plain iron cases for either indoor or outdoor use.

Fig. 1 shows a perspective view of the Moloney transformer; Fig. 2, a view of the core and coils, the cover being removed, and Fig. 3, curves of efficiency plotted from figures obtained from actual tests. Curve A shows the maximum efficiency at 133 cycles; Curve B, maximum efficiency at 60 cycles; Curve C, all-day efficiency at 133 cycles, and Curve D, all-day efficiency at 60 cycles.



EFFICIENCY CURVES OF TYPE A TRANSFORMER OF MOLONEY ELEC. CO.

To make certain that their transformers in the hands of an intelligent operator are safe and prove their merits, the company publish full instructions for the handling and testing of transformers. A catalogue containing these instructions and a description of Type A transformer will be sent to anyone on application to the company.

The Thermo Electric Co's Increasing Business.

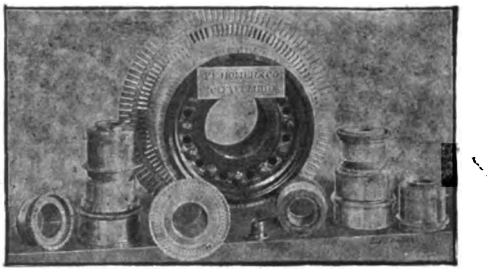
The Thermo Electric Company, which was recently organized to manufacture the improved Cox thermo generator, has lately increased the capacity of its factory to the output of 200 generators per week.

The demand for these generators for charging storage batteries for all purposes is continuously on the increase. As a source of power where a small amount of electrical energy is required, it is claimed there is nothing in the market that will equal them. A new application of the generator consists in placing the same around the exhaust pipe of gas engines, and the waste heat escaping from the engine is utilized in exploding the gas in the cylinder of the engine for the usual electric spark.

The many testimonials received from electro-platers show the superiority of this device for this purpose. Jewelers, doctors and dentists are rapidly discovering the great advantage of this machine for operating their various electrical devices.

F. E. Homer & Company, Cleveland, Ohio.

THIS firm makes a business of building and refilling commutators for generators and motors of every type and of any size, and claim to be the only concern in the country that devotes its entire energies to this line of work. The special claims made for their products are that only the very best material is em-



COMMUTATOR WORK OF F. E. HOMER & CO.

ployed and that the method of assembling and finishing, which differs materially from old methods, insures a commutator that will be durable and satisfactory in every particular. While this practice of building only from first-class material is followed when left to their choice, they are prepared to build commutators of such material in such a maner as may be selected by the customer.

Mica insulation only is employed, so that their products are perfect in this respect, and they also make solid mica rings for all commutators. The difference in cost between first and second-class material is strikingly emphasized by the fact that the cost of a commutator for a T.-H. D. 62 generator is $24 more where high-grade material is employed than when other grades are used, and yet, in appearance the difference could not be detected, but the wear will tell the story, and the best is always the cheapest.

In their dealings the firm make it a practice never to sell a cast bar for a drop forging, neither do they piece the mica for segment insulation. The name of the company is a guarantee for all their work, as they have been engaged in the manufacture of commutators since 1892 and have among their customers a number of street railway companies, whose commutator work they have done for the last six years. The output, however, is not confined to commutators for street railway work, but they make all the commutators for a number of the prominent electrical manufacturing companies of the country, as well as for electric lighting companies, and especially for isolated plants.

The business was originally established in 1892 on Water street, where they were burned out, when they moved to High street, and in May, 1897, to their present quarters in what is known as a part of the old Brush works, on Belden street. The building is a one-story brick structure, one-half of which, or a

Digitized by Google

space 30 by 140 feet, is occupied by the works of this company. The power for operating the tool equipment is supplied from a 5 h. p. gas engine, and there is a 1,000-volt alternating generator for testing purposes.

The equipment consists of a very fine class of metal-working tools, some of special design, and these are supplemented by a 20-ton press for pressing the bars in place, and a portable crane or hand-lift, which is mounted on castors, and which, by means of a handle, can be moved about the shop, thus facilitating the handling of heavy commutators and heavy material. The baking, to which special attention is given, is done in a galvanized iron oven in which gas is employed for fuel. With the present equipment the shops are able to turn out a large number of commutators per week.

Recent Sales by the Ridgway Dynamo & Engine Co.

The Ridgway Dynamo & Engine Company, Ridgway, Pa., builders of automatic engines and generators, report the following sales: Stineman Bros., South Fork, Pa., one 150 h. p. engine; W. H. Brown's Son, Pittsburg, Pa., one 18 h. p. engine direct connected to one 10-kilowatt generator; H. H. Stevens, Colorado Springs, Col., one 30 h. p. engine, direct connected to 15-kilowatt generator; village of Cass City, Mich., one 125 h. p. engine; Berwind-White Coal Mining Company, two 250 h. p. engines, making seven engines of this size and three 150-kilowatt generators furnished within the last fifteen months; Schoen Pressed Steel Company, through Messrs. Manning, Maxwell & Moore, of Pittsburg, one 160 h. p. engine, direct connected to 110-kilowatt generator, this being the fourth direct connected plant furnished the Schoen people; Link Belt Machinery Company, four 150 h. p. engines; Western Coal Mining Company, Yale, Kan., one 125 h. p. engine; Collins State Homeopathic Hospital, Collins, N. Y., one 40 h. p. engine direct connected to 25-kilowatt generator and one 80 h. p. engine direct connected to one 50-kilowatt generator; Mt. Olive & Staunton Coal Company, Staunton, Ill., through the Jeffery Manufacturing Company, Columbus, O., one 180 h. p. engine; Jefferson Medical College, Philadelphia, two 100 h. p. engines direct connected to two 60-kilowatt generators. Most of this work is yet to be shipped.

The Union Boiler Tube Cleaner.

Regardless of precautions taken and due principally to the impurity of the water used, steam boilers are often made inoperative and dangerous by the scale adhering to the tubes. One of the most efficient devices for the removal of this scale has been placed on the market by the Union Boiler Tube Cleaner Company, 250 Penn avenue, Pittsburg, Pa. It consists of a flexible shaft, the core of which is composed of links made of either aluminum, phosphor bronze or steel, depending on the duty required; this is incased in square steel wire made and tempered especially for this specific purpose, which is in turn covered with leather, or preferably, specially prepared rubber, warranted to stand 300 degrees of heat, and to be unaffected by the oil, or preferably hard grease, used in lubricating the core; it can be made to meet any requirement, and in any length of section up to eight feet; the parts being interchangeable, the sections can be rapidly coupled together to make a shaft of any desired length. As to its lasting qualities; doing drastic work, it is claimed that a No. 8 shaft 21 feet long, of 1¼-inch phosphor bronze core, ran for 23½ consecutive days, of ten hours each, at 2,000 revolutions per minute, doing 10 h. p. work, in curved tubes of boilers, removing scale running from ¼ to ⅝ of an inch in thickness, and of a very dense and tough quality, thereby putting an unequal strain on the core, with the result of only three links breaking in all that time. The remainder of the shaft after this crucial test was in such good condition that there was no evidence to show that it had ever been used at all; there being in actual use no wear on any part of the shaft, excepting on the links and the inner side of the wire casing, which, with the peculiar method of construction, makes an absolutely smooth interior and with the hard grease used as a lubricant does away with friction, and consequently, wear, on the links and casing to an extent that is simply astonishing. The contour of the links is such that in any position they are forced to assume they are neither affected by, nor do they affect, the slight opening formed on the one side of the wire casing while rounding a curve.

The company are prepared to make these shafts of any desired length or diameter and will be pleased to communicate with any concerns desirous of saving coal and lengthening the life of their boilers.

Popularity in Boston of Babcock & Wilcox Boilers.

That the Babcock & Wilcox boiler enjoys a deserved popularity in Boston and vicinity is evidenced by the large number of these boilers now in use in that city. The West End Street Railway Co. alone have in use 19,000 h. p. of Babcock & Wilcox boilers, distributed among their five power stations, the Central, East Cambridge, Charlestown, Dorchester and Harvard, which last station is illustrated in this issue. The Lynn & Boston Street Railway have 4,000 h. p. divided between the Chelsea and Lynn stations. The Edison Electric Illuminating Co., of Boston, 4,000 h. p., and the new station of the Boston Electric Light Co. will have 4,400 h. p. when completed, which will be in the near future. Such a showing is certainly of great credit to the Babcock & Wilcox Co. and doubtless will be favorably commented upon by the delegates to the convention in their visits to the various power houses.

Satisfactory Tests of Beacon Lamps.

For several months extensive tests have been made of Beacon incandescent lamps, the results of which have from time to time been noted in our columns. It appears from these tests that the initial candle power of the lamps is maintained beyond the time guaranteed by the company, and that the lamps have a long life and do not blacken. The guarantee is that the lamps retain their candle power for over 300 hours at small consumption of current. A test has lately been made in which a number of Beacon lamps were placed in circuit. After a number of hours half of the lamps were replaced by new ones, and it was impossible to tell which were the old and which were the new lamps in circuit. This also holds true for the series lamps for arc and incandescent circuits as well as miniature lamps.

The Duquesne Galvanizing Co.

BY A. D. McNAIR.

THE Duquesne Galvanizing Company, of Pittsburg, Pa., galvanize by a process of electroplating. There are two principal advantages in their process over the old "hot" process of galvanizing. First, the threads of bolts and nuts are galvanized without interfering with the nut screwing on properly. Second, the zinc coating never cracks or scales off, no matter how short the bend is.

The works of this company are located at Twenty-first and Smallman streets, in the city of Pittsburg, Pa., and have been in operation about six months. There is only one other works like this one in the United States.

Power is derived from a 35 h. p. "New Era" gas engine built by the New Era Iron Works, of Dayton, O. The engine uses natural gas, which is exploded by an electric spark and runs at 175 revolutions per minute. It is connected with the dynamo by counter shafting equipped with clutch to cut the dynamo out or in, as may be desired. The dynamo was built by the Otis Electric Company, of Yonkers, N. Y. It runs at the rate of 500 revolutions per minute, and gives a direct current of 2,000 amperes at a pressure of 6 volts. Owing to the low voltage, the field coils cannot be self-excited to the required degree, therefore an exciter is used. The latter runs at 800 revolutions per minute and gives a current of 5 amperes at 40 volts, the voltage and amperage in both dynamo and exciter being measured by Weston instruments. The main conductors are solid copper bars 3 inches wide and ½ inch thick.

The process of galvanizing is as follows: To remove any oil or grease that may be on the iron it is first immersed in a vat of hot caustic potash. To remove the scale which is always found on the surface of iron, it is next immersed in a vat of dilute muriatic acid, or, if the piece is of cast-iron, it is immersed in dilute hydro-fluoric acid instead. From these vats the pieces to be galvanized are taken and placed in a vat of clear water to rinse off the acid.

Next they are immersed in a "striking solution" of milky whiteness by being suspended from cathode bars, which results in their being coated with a film of tin. After another rinsing

Digitized by Google

in a tank of clear running water they are finally placed in the galvanizing vat, where they receive their final coating.

The galvanizing vat is 31 feet long, 4 feet wide and 5 feet deep. There are three anode and two cathode bars extending the whole length of the vat. The anodes proper are sheets of pure zinc, whose disintegration constantly replenishes the sulphate of zinc solution in the vat. The pieces to be galvanized are suspended from the cathode bars and are completely coated with zinc in about twenty minutes.

The final part of the process is to dip the pieces in a vat of hot water, which not only rinses them, but heats them so that they dry of their own heat.

An 8 h. p. boiler is used to heat water to keep several of the vats hot; viz., the caustic potash vat, the muriatic acid vat, the hydro-fluoric acid vat and the hot water vat.

A duplicate dynamo and galvanizing vat are about ready for use, which will double the capacity of the plant.

The process above described is not so well suited to galvanizing wire as the hot process, because it is not as expeditious, but it is better than the hot process for bolts, nuts, hoops, fence cleats for wire fences and other things too numerous to mention.

To show that the zinc coated by this process will not crack or scale, the following experiment was made before the writer: A strip of iron one inch wide and ⅛ inch thick was bent double and hammered down flat, yet the coating did not crack a particle.

In cutting threads on bolts and nuts designed to be galvanized a slight allowance should be made, else the nut will go on hard. This company is already supplying bolts for water meters, hoops for beer kegs and pickle kegs and fence cleats for a wire fence company. It is probable that galvanized bolts will find ready sale to the makers of agricultural machinery, because there is no class of machinery so much exposed to the weather and which suffers so much from rust as agricultural machinery. Bolts and nuts for rails would be improved by galvanizing them.

The officers of the company are: F. K. McCance, president; W. T. McCance, secretary and treasurer; R. O. Miller, general manager.

CATALOGUES.

The Albany Lubricating and Compound Cup Company.

A very interesting and complete catalogue of lubricating compounds has recently been issued by Adam Cook's Sons, 313 West street, New York. It contains a mint of information about the Albany Compound made by this company for engine, dynamo and railway lubricating purposes. The catalogue also contains illustrations of a great variety of oil cups manufactured by the company of sheet zinc, brass, glass and tin. The catalogue will be sent to any one on application.

Western Electric Company, Bulletin No. 5.

This bulletin recently issued by the Western Electric Company illustrates and gives prices of their station instruments. Their arc ammeter designed for station use is well protected by a sealed case, it has no springs or permanent magnets and it is dead beat and accurate within 1 per cent. The same can be said of their current indicator which is used to show the direction of the current. The voltmeter manufactured by this company is designed for use in dynamo switchboards and is made for voltages from 120 to 600. The magnetic vane meter is adapted to be placed directly in a circuit, no shunts or other devices being used in connection with it. The circular contains prices of all these instruments and will be sent to anyone on application.

WARREN O. The American Incandescent Lamp Company has made an assignment for the benefit of its creditors. Liabilities, $15,000.

The American Electrical Works Clambake.

WE are pleased to note that the twentieth annual clambake of the American Electrical Works will take place on Saturday, September 10, at the Bomham Club, Narragansett Bay, Providence, immediately following the street railway convention. It goes without saying that all recipients of invitations to the clambake of the year look forward to the event with great anticipation.

The Bacon Air Lift Company.

ELSEWHERE will be found an advertisement of the Bacon Air Lift Company with offices at 100 Broadway, New York. This company was organized for the purpose of doing a general water supply and hydraulic engineering business, making a specialty of the application of compressed air for pumping water and all kinds of liquids.

The Bacon aid lift pump has been on the market for more than four years, has had a large sale, and is operating at least three hundred wells, supplying water to various electric light and power plants, cities, towns, factories, breweries, etc, in different sections of the country. This company seems to have no difficulty in obtaining strong testimonial letters wherever they install plants, showing that their system is all that is claimed and gives good satisfaction.

The officers of the company are E. S. Hosmer, president; C. E. Bulk, vice-president; J. E. Bacon, secretary; John T. Gibson, treasurer, and the directors are: Henry Morton, Ph. D., president Stevens Institute of Technology, C. E. Bulk, J. E. Bacon, John T. Gibson, Col. A. A. Hosmer, Edward S. Hosmer, Geo. R. Young.

Messrs. Young and Gibson are quite well known through their long connection with the Blake and Knowles pump companies and are experienced in the matter of pumping machinery, also having been identified for the past three years with the Bacon air lift pump. Mr. J. E. Bacon has long been known as an expert in the matter of underground water supply.

Therefore, in devoting itself exclusively to the business of underground water supply the Bacon Air Lift Co. is in position to design and install well systems, also to furnish and install proper pumping machinery in connection therewith.

Interesting features of their mechanical appliances are the patents of Messrs. Young and Shaw, which are very successful and by which the field of usefulness in pumping liquids by compressed air is greatly broadened. With these inventions artesian wells may be operated when situated long distances from power houses, and at the same time the water discharged horizontally under pressure, thus utilizing sources of water supply which otherwise are beyond the possibilities of an air lift pump.

NEW ENGLAND NOTES

THE NORTON AND TAUNTON STREET RAILWAY COMPANY, NORTON, MASS., has been given permission by the railway commissioners of Massachusetts to issue $80,000 in bonds to build a power house and equip its lines with electricity. The overhead trolley system will be employed, there being 14 miles of circuit of No. 00 trolley wire and 0000 feed copper. The equipment will be furnished by the Walker Company for eleven cars, two box, three duplex, and six open, furnished by the Briggs Car Company, Amesbury, Mass., and equipped with Peckham trucks. They will install two 350 h. p. McIntosh & Seymour engines, and two 350 h. p. Babcock & Wilcox boilers. The power house will be built of brick. The officers of the company are: George H. Swazey, president; E. D. Hewings, treasurer, and Douglas A. Brooks, general manager.

SANDERSON & PORTER, contractors for the Meriden & Compounce Electric Railroad Company, have let the contract for furnishing several bridges and buildings on the line of this road to the Berlin Iron Bridge Company, of East Berlin, Conn. The work consists of seven spans of bridges, varying in length from 10 feet to 65 feet, a car barn 50 feet wide and 100 feet long and a power house 45 feet wide and 75 feet long. The bridges are of steel and the buildings have steel framework, brick side

Digitized by Google

walls and fireproof roofs. The roof of the power house is covered with corrugated iron and lined with the Berlin Iron Bridge Company's patent anti-condensation roof lining. This lining has shown itself efficient in preventing condensation and moisture from the under side of covering and doing away with the danger and annoyance of water dripping on the expensive and delicate machinery below.

WESTERN NOTES

WESTERVILLE, OHIO. The Westerville Electric Company has been incorporated by E. S. Aldrich, 11 Wesley Block, Columbus, O., and H. L. Bennet & Co., for the purpose of lighting that place. A contract has been secured for five years for 10 arc and 50 32 c. p. incandescent lights. The plant will be built at once, and Mr. Aldrich will be manager and engineer in charge of constructing plant. He wishes prices on a 40-kilowatt 220-volt generator, 10 220-volt arc lamps, 6,000 pounds w. p. wire and all supplies required to build plant.

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, Mo., report very large sales for the "Loricated" Iron Armored Conduit, for which they are agents, and predict for it very large sales in their territory this fall. A visit to their offices would seem to indicate that prosperity is indeed with them, as their large force of employees seem to be rushed with work in their various departments, and the management report that business this fall has more than exceeded their expectations; and they inform us that business seems to be most active in all of the five departments into which their business is divided. They have just issued a 753 page cloth bound catalogue, illustrating the general lines of electrical merchandise that they handle, but it seems they are now issuing books for their various departments in addition to this general catalogue, and we understand that their catalogue No. 16B, devoted entirely to electrical railway material, is now ready for distribution.

NEW YORK NOTES

GOLDMARK & WALLACE, 121 Worth street, New York, have recently received several large orders for Koch dynamo brushes. The fall season with them bids fair to be a large one.

ADVERTISERS' HINTS

THE BABCOCK & WILCOX CO., 29 Cortlandt street, New York, present some very interesting details regarding the selection of material used in the construction of their boilers. They also include a partial list of street railway companies for whom they have installed boilers. They state that nearly 2,000,000 h. p. have been sold by them and their output is nearly 300,000 h. p. per year.

THOMAS A. EDISON, Jr., 27 William street, New York, says that no central station manager who consults his own and his patrons' interests will fail to use the "Edison, Jr.," incandescent lamps. Several of their features are mentioned.

THE FOREST CITY ELECTRIC CO., Cleveland, Ohio, advertise drop-forged and roll drop commutator bars for railway and special uses in all styles and sizes made true to gauge of pure Lake copper. They also advertise the protected railbond designed to be placed under the first plate. They say it is flexible to vibration and yielding to expansion and contraction; has solid copper terminals, cast welded onto copper wires and no solder. They furnish screw welders for fastening the bond to rail, and will send samples and catalogues on application.

THE MOLONEY ELECTRIC CO., 6 North Twelfth street, St. Louis, Mo., advertise transformers which are fully described on another page of this issue.

THE C & C ELECTRIC CO., 143 Liberty street, New York, are building slow-speed multipolar generators in sizes ranging from 20 kilowatts to 200 kilowatts for belting or direct connection. Their substantial construction, correct design, and their ability to stand severe overloads without objectionable heating or sparking make them specially desirable for railway and power service.

F. E. HOMER & CO., Bush Building, Cleveland, Ohio, build, refill and repair commutators for motor generators and special work. They guarantee their work satisfactory.

JULIUS ANDRAE & SONS CO., Milwaukee, Wis., state that the "Andrae-Ericsson" telephone is made to receive sounds clear, sharp and strong, that exchanges equipped with them give perfect satisfaction.

THE CLEVELAND ELECTRIC TRADING CO., Cuyahoga Building, Cleveland, O., are out for business and want to sell, buy or exchange any old thing in the way of electrical apparatus.

THE ELECTRIC STORAGE BATTERY CO., Drexel Building, Philadelphia, advocate the use of the storage battery for trolley regulation. A very convincing testimonial as to their efficiency in this work from the Easton, Pa., Edison Co. may be found in their "ad" this week.

THE C. W. HUNT CO., Water street, Staten Island, N. Y., illustrate a large coal conveying plant they have just installed for the Calumet and Hecla Mining Co. at Linden, Mich. They note some of the features of this installation and have a word to say about their Manila rope transmission system.

THE GOLD STREET CAR HEATING CO., Frankfort and Cliff streets, New York, recommend their system of heating where the greatest amount of heat and a uniform distribution of the same is required at the least expenditure of current.

CONTENTS.

EDITORIALS:
The Electric Railway Outlook 234
The Trolley and the Fan as Health Givers 235
Dr. John Hopkinson, D. Sc., F. R. S. 235
War Inventions 235

ELECTRIC TRANSPORTATION:
The Harvard Power Station of the Boston Elevated Railway Co. (illustr.) ..... H. W. Weller, C. E., E. E. 217
Herrick's Electric Car Inspection System (illustr.) .. A. B. Herrick. 220
The Cross-County Roads at Cleveland, O. (illustr.) ..... C. B. Fairchild. 221
Cleveland, Berea, Elyria and Oberlin Railway Co. (illustr.) 222
Cleveland, Painesville & Eastern Railway Co. (illustr.) 225
The Boston Subway (illustr.) 227
The Buffalo & Lockport Electric Railway (illustr.) ... O. E. Dunlap. 228
Electrical Propulsion on Country Roads ..... James Ascher. 229
Power Consumption in Electric Railroading III. (illustr.) (concluded) ..... S. T. Dodd. 230

POWER TRANSMISSION:
The Canon City-Cripple Creek Power Transmission Plant in Operation; Mines Run by Electricity 231
Water Power Plants in the South 232

ELECTRIC LIGHTING:
Testing Arc Light Circuits—I ..... W. H. Markland. 232
Positive and Negative Economies in the Operation of Small Electric Light Plants—I ..... E. P. Roberts. 233

TELEPHONY AND TELEGRAPHY:
The Stone Telephone Repeater (illustr.).—The Telegraph in Porto Rico 236
Municipal Telephony in England 237

ROENTGEN RAYS:
Some Recent X-Ray Work 237

MISCELLANEOUS:
Apparatus for Illustrating Change of Phase Produced by Inductance or Capacity ..... Sidney T. Morland. 237
The Commutated Wave of a Composite Wound Alternator (illustr.) Prof. D. C. Jackson. 238
Capt. Robert Edwards, Jr. 238

SOCIETY AND CLUB NOTES:
Meeting of the New York State Street Railway Association.—Association of Edison Illuminating Companies.—Eighth Annual Meeting of the American Electro-Therapeutic Association 238

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Aug. 23, 1898. 239
Classified Digest of U. S. Electrical Patents, Issued Aug. 30, 1898. . 239

TRADE NOTES AND NOVELTIES:
The Moloney Electric Co.'s Type A Transformers (illustr.) 240
The Thermo-Electric Co.'s Increasing Business.—F. E. Homer & Co., Cleveland, O. (illustr.) 241
Recent Sales by the Ridgeway Dynamo and Engine Co.—The Union Boiler Tube Cleaner.—Popularity in Boston of Babcock & Wilcox Boilers.—Satisfactory Tests of Beacon Lamps.—The Duquesne Galvanizing Co. 242
The Albany Lubricating and Compound Cup Co.—Western Electric Co., Bulletin No. 5.—The Bacon Air Lift Co.—The American Electrical Works Annual Clambake.—New England Notes.—Western Notes 243
New York Notes.—Advertisers' Hints 244

Department News Items will be found in advertising pages.

Digitized by Google

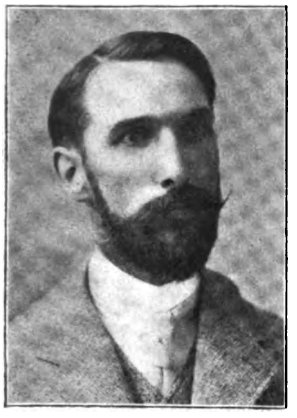
The Electrical Engineer.

Vol. XXVI. SEPTEMBER 15, 1898. No. 541.

THE CROSS-COUNTRY ROADS AT CLEVELAND, OHIO.—II.

BY C. B. FAIRCHILD.

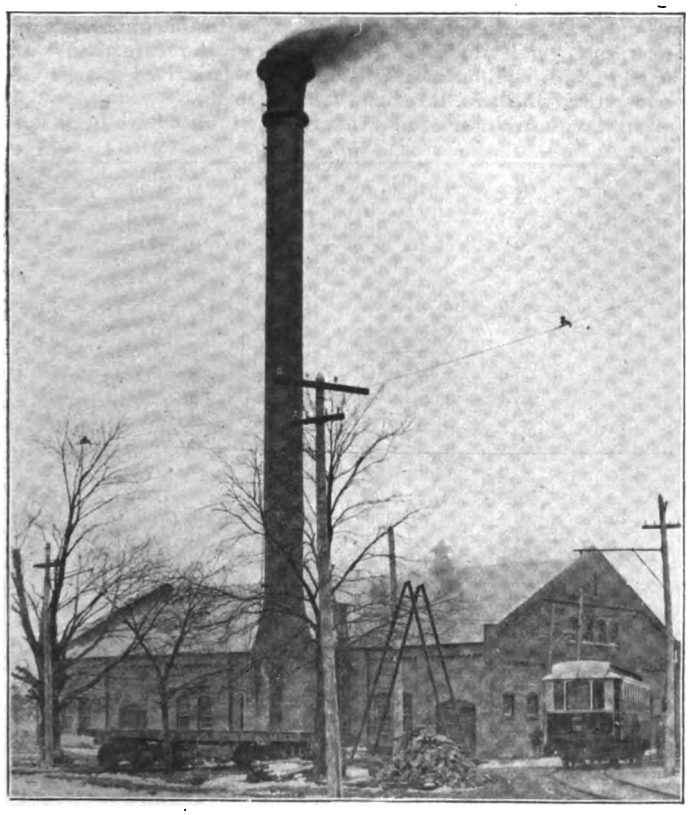
The Akron, Bedford & Cleveland Railroad Company.



Mr. Will Christy.

THIS was the second of the cross-country lines to be constructed, and had its inception in the fertile brain of Mr. Will Christy, who was mentioned in connection with the development of the Cleveland & Berea line, he having been prominently identified with the Akron, Bedford & Cleveland Railroad Company since its origin. The line, which was opened in 1895, extends in a southeasterly direction from Cleveland through a prosperous farming country, with houses at short intervals all along the route, owned by wealthy farmers, who are liberal patrons of the line.

The route is through a rolling country, some of the grades being quite abrupt, and the road dives in and out of narrow valleys with an ever-changing landscape view. While there is frequent change in grade, none of the hills is very steep until the suburbs of Akron are reached, when the road makes an abrupt turn around the edge of a steep cliff along the cañon of the Cuyahoga River, where it descends rather abruptlly, crosses a steel truss bridge over the cañon, and after a sharp rise descends to the city over a precipitous grade 1,100 feet in length, with an average grade of 11½ per cent., but with a maximum of 13 per cent., near the crown of the hill. The region about the Cuyahoga Cañon is very wild, and the glens provide many attractive features for pleasure-seekers. The glen is about as Nature made it, but the company is undertaking improvements in the way of laying out walks and providing shelter. Besides the scenery of the Cuyahoga River to make this neighborhood attractive is the region about Silver Lake, less than a mile distant, which has also been fitted up as a pleasure resort. To this lake a branch road has been built, and during the summer season A. B. & C. excursion trains are run direct to the grounds.



CUYAHOGA FALLS POWER STATION, A. B. & C. R. R.

The main line passes through the villages of Bedford and Cuyahoga Falls to Akron, which is a progressive manufacturing city, having, with its suburbs, a population of about 40,000. The city is noted for its numerous potteries, in which clay products of almost every description are manufactured, some of the largest works being devoted to the manufacture of sewer pipe, vitrified clay conduits for electric wires and porcelain insulation. There is also a very large establishment engaged in the manufacture of rubber goods, including hard rubber for insulating purposes, known as the B. F. Goodrich Company, and one in the manufacture of electrical supplies. The farm and dairy products of the region furnish considerable business for the road, this being especially true of the milk trade. The line throughout its entire length has many attractive features for pleasure seekers, and notwithstanding it parallels two steam lines which operate between Cleveland and Akron, it enjoys a very liberal patronage, which is constantly increasing because of the new homes that are being erected along the line of the road. Many city people have been induced to leave the city for a country life "where they can have the skies and woods for friends."

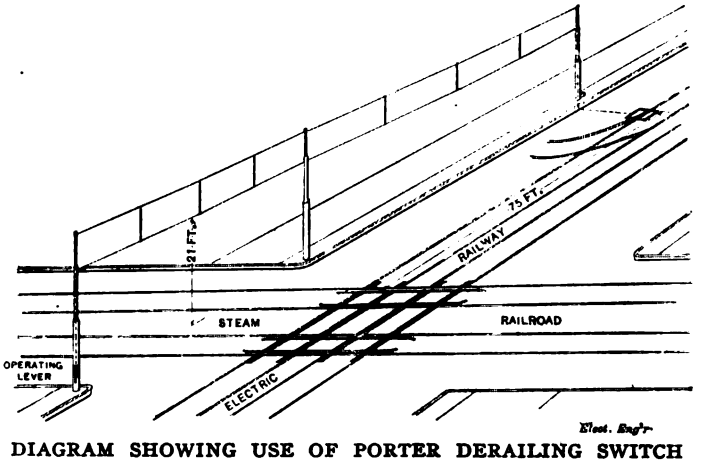


DIAGRAM SHOWING USE OF PORTER DERAILING SWITCH ON A. B. & C. R. R.

The total distance from Square to Square in the two cities is thirty-six miles, and the cars are run on a half-hour headway, requiring two hours and ten minutes to make the trip. The schedule speed, outside of the cities, is twenty-five miles per hour, but on the level sections and on long down grades the speed frequently reaches forty and even fifty miles per hour. The fare for the round trip, including a transfer in each city, is $1; for one way, 60 cents.

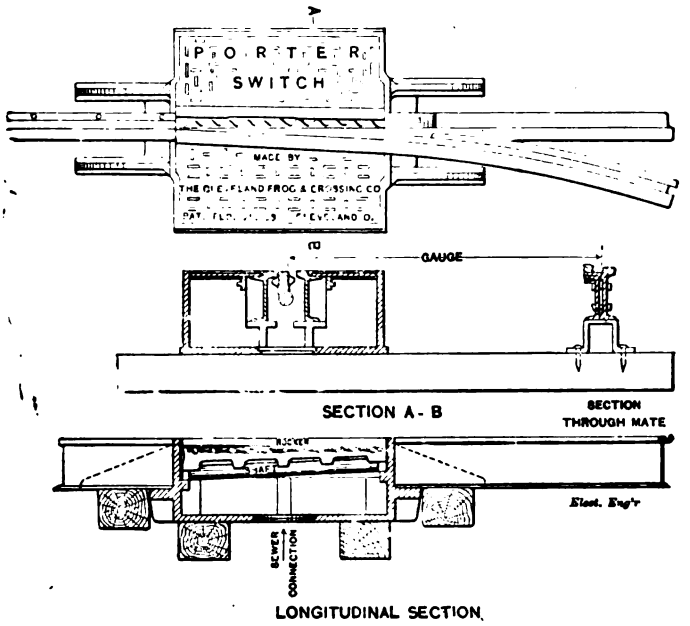
ROADBED AND OVERHEAD CONSTRUCTION.

The tracks are laid along one side of the highway, the roadbed being slightly turnpiked to provide for drainage. The more recently constructed portions of the track are of 70-pound tee rail, heavily bonded with a large contact, laid on large ties 6x9 inches by 8 feet, and spaced two feet centres, this being the adopted standard. Turnouts, with suitable spring switches, are provided at such intervals as allow for a half-hour headway. From Cuyahoga Falls to Akron the road is double tracked. Telephone boxes at each of the turnouts enable conductors to communicate with the superintendent and receive orders. Formerly they were required to report at each turnout and receive orders, but now, if on schedule time, the conductors report only at the terminals. Derailing switches are provided at steam railway crossings.

Digitized by Google

These switches, of the Porter type, are manufactured by The Cleveland Frog & Crossing Company, of Cleveland. In normal position the switch is open, leading into blind tracks, and before the car can pass it is necessary for the conductor to go forward, cross the steam track and work the operating lever which is attached to one of the side poles as shown in the illustration. The motion of the lever actuates a second lever near the top of the pole from which a wire leads to a pole opposite the switch, where it is attached to a second lever, to which is connected a wire within the tubular pole and which leads out from the base of the pole to the switch, and by means of which the switch is closed for the passage of the car. The same arrangement is followed at drawbridges, and is so arranged that the lever cannot be operated when the draw is open. In some cases the operating lever is attached to a pole on the near side of the crossing, but usually on the opposite side. The position of the switch tongue and rocker bar are clearly shown in the engravings on this page.

Woden side poles with brackets support the trolley and feed wires, and at suitable intervals large-lettered signs showing stop



PORTER DERAILING SWITCH USED ON A. B. & C. R. R.

numbers or stations are attached to the poles. The stations are about one-sixth of a mile apart. At some of the crossroads and at important stations the company has provided small artistic waiting rooms.

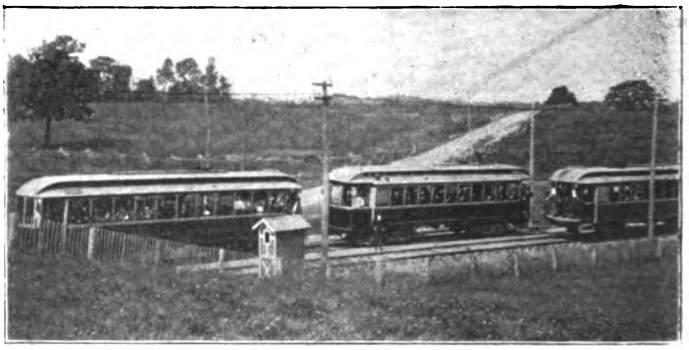
In addition to the steel bridge noted above, over the cañon at the Cuyahoga River, the line crosses another similar structure near Bedford which is 300 feet in length and was built by the company at a cost of $19,000.

POWER STATIONS.

The power is supplied from two plants, one located near Bedford, the other at Cuyahoga Falls. The former occupies a wooden building on the bank of Tinkers Creek and has a capacity of about 600 h. p., included in two units, the engines being simple and belted to Westinghouse multipolar generators; the latter, a brick building, shown in the accompanying engraving, having about the same capacity and being of the same type as the former. The engines are manufactured by the Edward P. Allis Company. The feed wires of the two stations are coupled and the current at the stations is under a tension of 625 volts. The longest distance to which it is carried is nine miles. The capacity of the stations is said to be ample for the operation of the line, notwithstanding the heavy grades. In this connection it may be noted that some of the parties active in the construction of this line are now engaged in building another extensive cross-country road in the southern part of the State, and for this new line have duplicated the Cuyahoga Falls power station equipment. The main repair shop and car house is of brick and is in connection with the Cuyahoga Falls station, at which point are the offices of the superintendent. The offices of the financial and clerical departments occupy rooms in the Garfield Building, Cleveland.

ROLLING STOCK.

The rolling stock consists of twenty-one double-truck cars, an electric snow plough and a number of flat gravel cars. It re-



TRAINS PASSING AT SILVER LAKE SWITCH, A. B. & C. R. R.

quires ten cars to cover the line with the headway as noted above. The car bodies are of Brill manufacture, mounted on Brill No. 27 trucks, are 41 feet long over all and 8 feet 5 inches wide. They are vestibuled and run one way only, loops being provided at each terminal for turning. The cars are divided by a glass partition into two compartments, the forward and smaller one for smokers. Those designed for freight and express have a freight compartment without seats. The cars are constructed with double floors, with paper lining between for warmth, and are all painted a light medium red. The seats are upholstered in plush, which will, however, be rapidly replaced with rattan, and are the same size as those employed in steam practice. Each car is provided with a toilet closet and tank for ice water.

These cars were formerly equipped with two Westinghouse 50 h. p. motors, but more recently a G. E. four-motor equipment has been adopted, with the intention of hauling trailers as the traffic demands. It is found that the cars with four motors make better speed and climb the grades with greater ease than with the two-motor equipment. This decision was arrived at after experimenting with two, three and four motors.

With the four-motor equipments electric brakes have been sub-

CUYAHOGA FALLS, ON LINE OF A. B. & C. R. R.

stituted for the air brakes formerly used. The history of the air brake equipment on these cars is very interesting. The first eight cars equipped were provided with the Hunt air brakes, with axle-driven compressors, after which several independent motor compressors made by the same company were tried. This equipment was followed by eleven equipments supplied by the Standard Airbrake Company with their geared axle compressors. These were installed in August, 1896, and some of them are still running. A trial was also made with one equipment furnished by the National Airbrake Company, and later a number of cars were equipped with the Christensen type of air brake furnished by the Christensen Engineering Company, of Milwaukee, includ-

Digitized by Google

ing a trial with both axle and motor-driven compressor, all of which are to be replaced by the electric brakes as fast as the four motors are mounted. The experience with some of these air-brakes was in the main satisfactory at the time, but the electric brakes which were put into service on the Cleveland, Painesville & Eastern Railroad and the Lorain & Cleveland Railway having proved satisfactory, brought about the change on the A., B. & C. Railroad. The use of the air whistle in connection with the air brake is said to be a very desirable feature, and the installation on each car of a small motor compressor with a storage tank to provide for blowing the whistle is contemplated.

It is interesting to note the evolution of the cars, motors and trucks in the experience of this road. At first the electric companies opposed the introduction of eight-wheel cars and objected to furnishing an equipment for speeds above twenty-five miles an hour, so that the management was forced to resort to its own designs and seek such builders and manufacturers as would accede to the new demands. Only one company of car builders at first would undertake to build the long cars, and these were replaced after an experience of eight months; in time, however, builders have been enabled to employ such material and so frame their cars that they are now standing up for the most part very successfully under the excessive strain to which they are subjected. Some few, however, are being rebuilt. This company was the first to employ double-plate wheels in this class of service, following the experience of steam roads.

The Akron, Bedford & Cleveland Railroad Company have constructed a large snow plough, or electric locomotive, which is used for clearing snow from the tracks, for hauling gravel cars and for shifting trains of steam railway coaches over the Silver Lake spur from Cuyahoga Falls. This locomotive is equipped with four motors, each of 50 h. p., and is provided with automatic air brakes of the Christensen type, a motor compressor of 5 h. p. being employed.

TRAFFIC.

The number of passengers carried during 1896 was 461,238; in 1897, 476,803; in 1898, to August 1, 262,898, having gradually increased since the road was opened, varying, however, from month to month, depending upon the weather. The express and freight business is at present in a state of reorganization owing to general withdrawal of old-time companies from the electric railroads. The company makes considerable concession in the rates of fare for picnic parties, and gives much attention to this class of traffic.

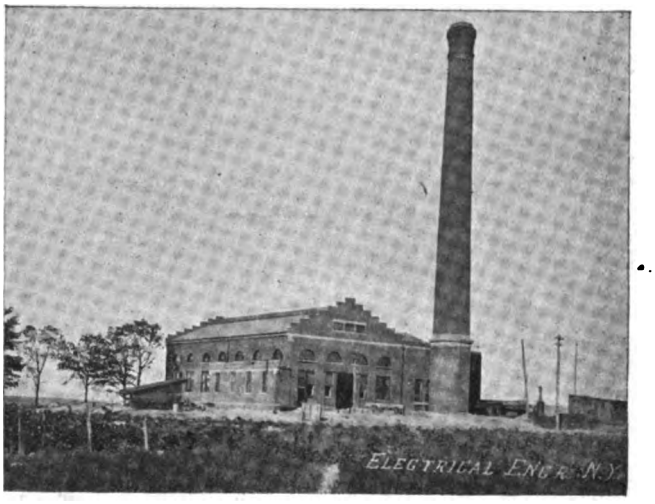
OFFICIALS.

The affairs of the company are under the direction of Mr. H. A. Everett, president, who is also prominently identified with three other of these roads. Mr. Everett is well known to the street railway fraternity from his former connection with one of the largest street railway systems of Cleveland, and later on with the street railways in Toronto, Canada, and with one of the system in Detroit, Mich. Charles W. Mason is vice-president, and Mr. F. S. Borton, secretary. Mr. F. J. J. Sloat, formerly superintendent, has severed his connection with the company and is now engaged in building a new line in the southern part of the State, being succeeded as superintendent by Mr. L. E. Beilstein, who is also superintendent of the Cleveland, Painesville & Eastern Railroad.

The Lorain & Cleveland Railway.

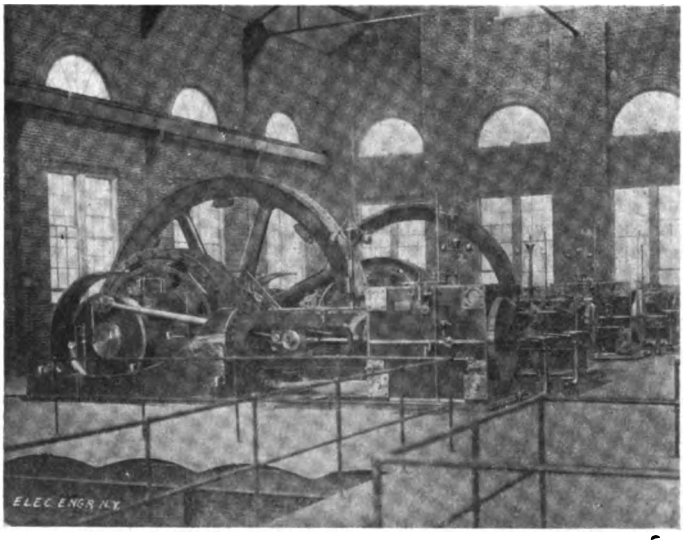
THIS was the last of this group of roads to be constructed, having been opened October, 1897, and naturally it embraces all the essential features that the years of previous experience on the older lines had suggested, and it is built from start to finish with an eye single to efficiency and durability. The route is over a perfectly level region, due west from Cleveland, parallel at a distance of about one-fourth of a mile with the shore line of Lake Erie, and is located throughout the whole extent on a private right of way, the county road being between it and the lake shore. The right of way is from 40 to 60 feet in width and guarded throughout by a wire fence made by the Page Woven Wire Fencing Company, of Adrian, Mich. Like the other lines, it runs through a farming region, but one which is almost entirely devoted to fruit raising, the principal varieties of which are grapes, peaches and berries. The grape product, however, predominates, and much of the way on both sides of the line well kept vineyards extend away almost as far as the eye can reach. Pretty homes may be seen through the trees, and the blue waters of the lake are in view to the north almost throughout the entire length.

Within the city limits the line extends for seven and one-half miles along Detroit street, one of the prettiest residence streets in the city of Cleveland, the lawns of which are ornamented with shrubbery, shade trees and flowers in a lavish manner. Next come a few truck farms, and at long intervals little patches of woodland, which add variety to the natural attractions. The surface is on an average of from 20 to 30 feet above the level of the lake, or at just enough elevation to give a water view of wide expanse, which is dotted here and there with the lake shipping and the pleasure boats for which these waters are noted.



POWER HOUSE, LORAIN & CLEVELAND R. R.

The traffic for the line is mostly from the terminals, and in good weather it is largely a pleasure traffic, there being numerous parks located along the lake front. One of the largest of these—that known as Avon Beach Park—is owned and operated by the railroad company, and embraces a tract of 65 acres, with a water front of 1,600 feet, having a charming bathing beach. Here the company have erected a large pavilion, laid out walks, set shade trees and have already made it a very attractive place.



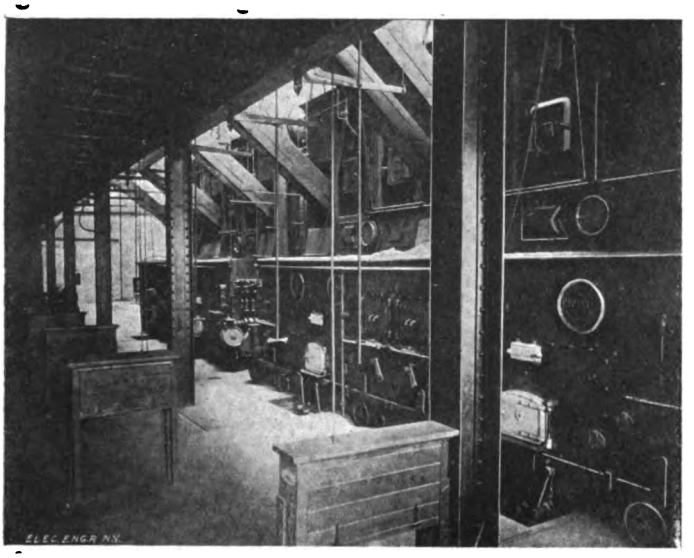
ENGINE AND DYNAMO ROOM, L. & C. R. R.

The line termintes at Lorain, a flourishing city of about 15,000 inhabitants. Near by are located the extensive rolling mills and blast furnaces of the Johnson Company, and here are the extensive coal and ore docks of the Cleveland, Lorain & Wheeling Railway and also the roundhouses and repair shops for the same road. The extensive shipyards of the Cleveland Shipbuilding Company are also located here, in which about 2,000 hands are employed. The harbor is also a rendezvous in winter for a large number of the lake craft, twenty-one ships of one company

Digitized by Google

having been docked here last winter, the crews of which are usually good patrons of the line.

The distance from city to city is twenty-six and one-half miles, and the headway of the cars is one-half hour, so that it required six cars to cover the line. The fare one way is 45 cents and 80 cents for the round trip. The schedule speed outside the city limits of Cleveland, including stops, is thirty miles an hour. On some of the long, straight sections it is fifty-five miles per hour; on speed tests the cars have been run as high as sixty miles per



BOILER ROOM, LORAIN & CLEVELAND R. R.

hour. One who has never had experience in riding on an electric car at this speed can form no idea of how rapid a pace this is—the sensation is so different from that experienced on steam cars. It is usually highly enjoyable, for no one seems to have any sense of danger, or at least, not as much as many people experience on steam cars running at this speed.

ROADBED AND OVERHEAD CONSTRUCTION.

The soil, which is a light clay, is well turnpiked, and the line is ballasted throughout with gravel, which was brought by rail a distance of seventy miles. The construction and equipment of the roadbed copies in every detail that of the American Society of Civil Engineers standard pattern. The rails weigh 70 pounds per yard and are rolled in 60-foot lengths, being connected at the joints with four-bolt splice bars, with nuts and locks on the inside. The joints are bonded with the Columbia type of bond 7 inches in length and of 250,000 c. m. capacity. These are attached to the under side of the rail between the ties. There are five turnouts, each of which is 1,500 feet in length. This furnishes a good meeting distance, so that the cars usually pass without stopping. Spring frogs and also a combination of spring and throw switches are employed. All are provided with signal and switch lamps and targets, after the manner of steam road practice. All the special work was designed by and supplied from the Cleveland Frog and Switch Company.

A double line of trolley wire is provided throughout, and there is not an overhead switch on the system. The trolley wire section is of the cloverleaf or figure-8 form, No. 000, and the two wires are supported about six inches apart from span wires, which in turn are supported from a double row of wooden poles having cross-arms for carrying the feed wire. The latter embrace $80,000 worth of copper, and there are six feeders leading out, three in each direction, from the power station, with a capacity of 300,000 c. m. each.

The poles are all braced on the inside by 8-foot timbers, which rest against stubs driven four feet deep by piledrivers. On the curves each pole is strengthened by a truss brace composed of strands of heavy galvanized wire, with a turnbuckle in each one. This insures a perfect adjustment of the trolley wires on the curves. The poles on the tangents are spaced 90 feet apart. At certain intervals on the poles there are signs, which read "Stop No. ——." These mark the points at which passengers may be taken up or leave the car.

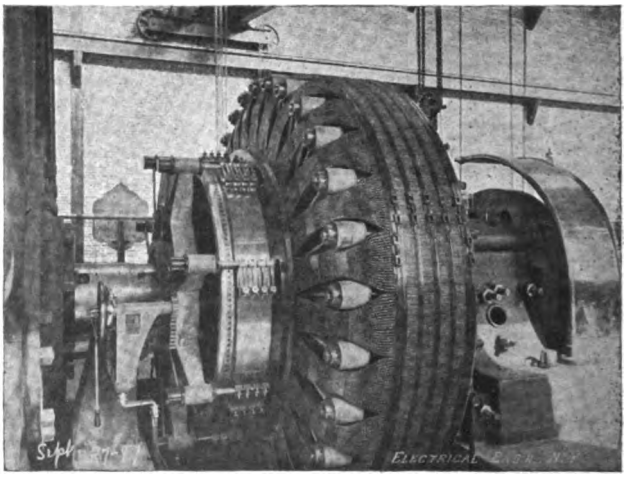
Not far from the city line the road passes over a long steel truss county bridge, which is 120 feet above the water and spans the cañon of the Rock River. There are four other extensive trestle bridges which were built by the company and which serve to span the channels of small streams. These are of oak and rest on solid foundations. All the bridges are provided with double guard rails, and on all the short curves a single guard rail is placed. A "Y" is provided at the Lorain terminal for turning the cars, and in Cleveland they loop around the Soldiers' Monument, as noted above.

POWER PLANT.

The current is supplied from a single station, which is located at Avon Beach Park, close to the lake shore, twelve miles from Cleveland city limits and seven and one-half from Lorain. The building is of brick, tasteful in design, with a ground area of 100x100 feet. The roof, in which there is a large area of skylight, is supported by steel truss girders, and the floor is cement, so the building is practically fireproof, there being no wood except in the window casing. Four Stirling water tube boilers of 250 h. p. each generate the steam, and these are equipped with the Murphy automatic stokers and coal-handling apparatus, by which the coal is weighed automatically and fed into the hoppers through closed chutes, so that there is no escape of dust. A steam pressure of 130 pounds is usually carried. Five pair of Fairbank scales located on the boiler room floor indicate the weight of the coal, the hoppers and chutes being operated by levers extending up to the steel storage tanks, which are located a little above the boilers and into which the coal is discharged from the steam cars, which are hauled from a neighboring siding by means of an electric construction car onto the steel structures which support the coal bins. The cheapest kind of slack coal is employed for fuel. The feed water is obtained from the lake through a sunken pipe 1,500 feet in length and 24 inches in diameter, which is protected by a crib. The boilers, condensers and pumps are located in a chamber 22 feet below the level of the engine room, the space having been blasted out from the shale rock. Brick walls and cement flooring protect the whole from moisture and provide ample space, so that every machine is readily accessible.

The condensers are of the Blake marine vertical type, with cylinders 10x22x15 inches, so arranged that either one will work with either engine. All the auxiliary steam pipes are in duplicate and are equipped with the Hawley return system and the Thomas feed water governor. The condensing apparatus is so coupled that the engines can be run condensing or high pressure.

The smokestack is of brick, with a 10-foot flue at the base. The base up to the stone coping, a distance of 40 feet, is octagonal in shape and circular above, being in all 200 feet in height.



SIEMENS & HALSKE GENERATOR, LORAIN & CLEVELAND RAILROAD.

To this the smoke is led from the boilers by means of a sheet steel flue.

The power equipment of the station consists of two cross-compound condensing engines of 550 h. p. each. These are of the Cooper-Corliss type and are manufactured by the C. & G. Cooper Company, Mt. Vernon, O. The two cylinders are 20x48 and 36x48, respectively, and are placed about 20 feet apart, so that the crank-bar of each is connected with either end of the generator shaft. There are two governors, that for the steam

Digitized by Google

pipe being operated from the low pressure side; the other, an emergency governor, which, when it operates above the danger line, not only cuts off the steam but opens a circuit-breaker on the switchboard. The flywheel is 20 feet in diameter and weighs 60,000 pounds.

The generators are each 400 kilowatts capacity, of a new type, with a special design commutator manufactured by the Siemens & Halske Company, of America, at their Chicago works. In this machine the fields are supported on a spider attached to the pillow block on one side and the armature, which is carried by the shaft spider. is cup-shaped, and the coils revolve outside of the field, which arrangement allows of a comparatively low speed, as the engines run only at 85 revolutions per minute. The equipment so far is operating in a highly satisfactory manner and has been tested up to an overload much above the guaranteed

DOUBLE TRACK GIRDER SPAN OVER L. & C. R. R. TRACKS.

capacity. The engines are provided with an automatic oiling device, so that the oil is filtered and returned in a highly economical manner.

The switchboard is equipped with Siemens & Halske switches and the station is protected by tank and Garton lightning arresters and fuses. The auxiliary equipment of the station consists of an overhead traveling crane of 15 tons capacity, with block-lifts of the Yale & Towne type. The steel girders for the crane were provided by the Cleveland Punch and Shear Works and the structural steel by the Forest City Wire and Iron Company. The station is lighted with natural gas from a near-by well, which is driven to a depth of 835 feet. The company also own a second gas well, from which gas is obtained for lighting purposes. The longest distance to which current is carried is twelve miles.

The power station is operated by five men, who work in two shifts, an engineer and fireman being on duty all the time, with an extra man, whose duty it is to see to getting in the coal, taking out the ashes and general cleaning. He also relieves the chief engineer when it is necessary for the latter to be absent from the engine room for construction or repairs. The same number of men would operate the station with twice the output. There is room provided in the engine room for the installation of an additional 1,000 kilowatt unit and room for additional boiler equipment.

The accompanying tables are copied from the log book of the station, and will be found interesting:

Power house report for week ending July 10, 1898.

POWER HOUSE REPORT.

Day.	Kilowatts. 24 hours.	Coal per 24 hours. lbs.	Coal per K. W. lbs.	Coal per H. P. lbs.
Monday	3,969	20,145	5.0	3.7
Tuesday	3,059	16,050	5.2	3.8
Wednesday	2,814	16,675	5.9	4.4
Thursday	2,842	15,825	5.5	4.1
Friday	2,569	15,910	6.1	4.5
Saturday	3,090	16,705	5.4	4.0
Sunday	2,968	16,430	5.5	4.1
Total	2,1311	117,740	...	...

Average kilowatts per days	3,044
Average kilowatts per hour	176—
Average coal per kilowatt	5.5
Average coal per horse power	4.0

CAR HOUSE.

The car house and repair shop, which also contain offices for the superintendent and operating offices, is a handsome brick structure 200x65 feet, and is located at Avon Beach Park beside the tracks, about 1,000 feet south of the power station. This is the operating centre of the system, and is, as before noted, about twelve and one-half miles from the Cleveland city limits.

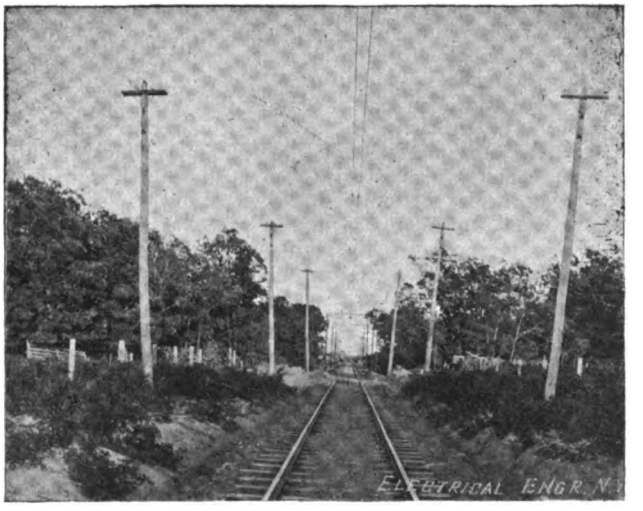
The repair shop proper is provided with repair pits, in which are located hydraulic portable lifts for handling the armatures, and there is a very creditable equipment of iron working tools, including radial drills, manufactured by W. F. & John Barnes, of Rockford, Ill., and a shaper manufactured by the Ohio Machine Tool Co., of Canton, O. The power for operating the tools is derived from an electric motor, which is run from the line circuit with suitable resistance coils and a circuit breaker like those described for use on the cars. There are two trolley lifts, one of five tons and the other of one ton capacity. A small fan provides air for blowing the forges and there is a hot water system of heating, in which the fuel is natural gas. A second story over a portion of the building provides for store room and for the woodworking department.

ROLLING STOCK.

The car equipment consists of twelve eight-wheel cars, which are all manufactured by the J. G. Brill Company, of Philadelphia; four of these are of recent purchase, the original equipment of the road having been eight cars. The length of these cars over all is 41 feet 10 inches, with 4-foot vestibules, so that the bodies are about 34 feet inside and 8 feet 6½ inches outside measurement. Smoking compartments have been added to six of the original equipment, and rear vestibules have also been put on. Two of the four new cars have baggage compartments.

These cars were essentially described above in connection with one of the other roads, which purchased cars from the same builder. They are, however, somewhat stronger, and in each post a ⅞" steel rod is inserted, which is anchored to the steel sill and also to the deck timbers. The carlins are also somewhat stronger than usually supplied. The floors are double, with suitable lining. The interior finish is of light mahogany, with quartered oak ceilings having border decorations. The deck lights are of slightly chipped glass and are operated in groups of two or three by worm and gear arrangement. The glazing is all of plate glass, one-quarter of an inch in thickness, and the partitions between compartments and between the body and vestibules have large glass panels, it having been observed that passengers favor glass partitions, as it gives them a chance to see forward and backward as they travel, and they can watch the movements of the car men. Mirrors occupy the upper corners of the end panels. The seats are of the Bushnell type, some with arms and some without, and are finished in three different styles. In some cars they are upholstered with leather, in other with rattan and still others with old gold plush.

The exterior is painted in Tuscan red, with gold-leaf letters,



TRACK AND LINE CONSTRUCTION, LORAIN & CLEVELAND RAILROAD.

and the interior of the vestibules and door posts are painted white. Electric heaters of the Consolidated Car Heating Company's manufacture are placed under each seat and in the vestibules. Folding safety gates are provided for the rear platform. In some of the cars the rear dash is composed of steel grating.

Digitized by Google

There are no closets or water tanks. Every car is provided with a portable telephone, which can be attached to the circuit every quarter of a mile, suitable switches being provided and attached to the side poles. There are also stationary telephones at the terminals and at the sidings.

The incandescent lamps are arranged in groups of four, with bronze ornamental holders. There is also an oil lamp provided at each end. The headlights are of the largest size employed on locomotives in steam practice and consume headlight oil. Two incandescent lamps are placed in the sign case on the front dash. Under the canopy in each vestibule in connection with the switch is placed a circuit-breaker of 500 ampere capacity. This is of General Electric manufacture and of "formal" type. No safety fuses are used on the cars. On the floor of each cab is located a ½ h. p. electric motor compressor, also of the General Electric type, which is designed to provide air pressure for sounding the whistles, which are considered necessary safety adjuncts in the operation of this class of high-speed cars. This is started by an automatic controller, and the storage tank, which is about a foot in diameter and three feet long, is suspended from the hood of the cab. The maximum pressure is 30 pounds, and the automatic controller operates under a range of between 30 and 22 pounds.

The trucks are of the Brill No. 27 type, extra heavy, being about 2,000 pounds heavier than the ordinary make of these trucks. The wheel base is 5 feet 10 inches and the double plate wheels are 33 inches in diameter. The power equipment of each car consists of four motors of General Electric make No. 57 and nominally rated at 50 h. p., but about one-fourth over design to provide for operating the electric brakes with which all the cars are equipped. These brakes also are of the General Electric type.

Electric brakes, it should be understood, do not provide a power for operating the wheel brake, but the retarding effect is secured by means of magnetic discs, which are attached to the axle. The discs are about 20 inches in diameter, and in the case of cars having the four motors the revolving disc is cast in the face of the wheel. The stationary shoe disc is mounted loosely on the axle and is provided with coils, which produce magnetic effect in the face of the disc and cause it to approach to the revolving disc. In the operation of the brakes the current is generated by the motors, which are coupled as generators in the act of braking. A special controller known as the G. E. No. B 8 is provided for operating cars having electric brakes. The retarding effect is not due entirely to the friction between the dics, as in the case of ordinary momentum friction brakes, but is chiefly due to the making and breaking of the magnetic circuit. The frictional wear between the discs is comparatively light.

The disc on the car wheel will always outlast the life of the wheel, while that of the stationary disc shoe can be worn off to the depth of about one-half inch, and in the case of this line, has a life of about eight months, when a new face of soft cast metal ⅝" in thickness is bolted on at a cost of a few dollars and saves the renewing of the magnetic disc, which would ordinarily cost about $33. In casting the renewing plates irregular channels are left in the metal about a half an inch wide, which are filled with babbit, which is planed off flush with the face of the disc. This provides for lubricating the face of the discs and prevents the metal from being melted by the excessive heat generated in the stopping of these high-speed cars.

This method of braking is in high favor with the officers of the road, as it is claimed to be very economical, the expense for renewal being much less than that required in the renewal of brake shoes with other types of brakes. On commercial tests one of these cars, which weighs ordinarily 40,000 pounds without passengers, can be stopped when running at a 45-mile speed in a distance of 311 feet on a good rail, or in 11 seconds.

The trolley wheels are of ordinary size, but are cast from a special composition of metal, which gives them a life of nearly a week, even at these high speeds. These are provided with an unusually large graphite bushing, the dimensions being 2x⅝ inches.

An electric construction car of the J. G. Brill manufacture, which is equipped with four motors, is utilized for hauling and shifting the coal cars, and in winter by attaching a suitable nose and flange is utilized as a snow plough. The region, however, is not subject to a very heavy fall of snow. Being so near the lake there is but little accumulation.

TRAFFIC.

The number of passengers carried thus far since the opening of the road in October last is 258,000, with a notable increase from month to month. There is also a considerable income from the express and freight traffic, which is controlled by the company's messengers, but which is not yet as extensive as on some of the other lines.

In the construction of the line Mr. C. W. Wason, who is also identified with some of the other lines, acted as consulting engineer for the entire work, Mr. A. P. Ruggles being chief engineer. The power house construction and equipment was entrusted to E. P. Roberts & Co., consulting engineers, with J. N. Richardson as architect, who also designed the car house.

The business and operating affairs of the company are under the management of Mr. B. Mahler, president, to whose efforts chiefly the line had its origin; E. G. Tillotson, vice-president; E. W. Moore, treasurer; J. B. Hoge, secretary, and F. W. Coen, assistant secretary. W. E. Davis, formerly connected with one of the Detroit railway systems, is superintendent.

The Carrying of United States Mail Matter on Interurban and Street Railways.[1]

BY W. S. DIMMOCK.

THERE is probably nothing, or one might say, no one thing which is of more importance to the perfection of an absolutely satisfactory mail service than the saving of time; the electric canceling machine and the numerous contrivances of the manufacturers' craft employed in the handling of mail matter, all aim at the one end—economy of time. This is probably the most potent argument in favor of the electric car service for the transmittal of mail matter to and from depots, sub and suburban stations, to the main post offices. As a general proposition the schedule time of the electric cars is absolutely to be depended on; experience has demonstrated that the list of casualties likely to interfere with the progress of a car upon its designated route is smaller than that which often hinders the wagon service. In the case of the Omaha office, where I have had the best opportunity for observation, a noticeable gain is made in the service between Omaha and Council Bluffs, a distance of five miles, and Omaha and South Omaha, of the same distance. Here the advantage is not confined to the saving of time, but in the increased number of dispatches it is possible to make. The frequency and regularity of time on the electric car lines makes it possible to dispatch mail matter from one office to another, or from main office to substations, to the best possible advantage, since the time can be regulated by the dispatching office at will in order to make certain outgoing trips of carriers, whom it might be impossible to reach if the regular running time of the regular mail trains must be considered, or the possibility of using the wagon service.

Before the electric line between Omaha and Council Bluffs undertook to handle the mails between these cities the mails left the main post office by wagon, and were conveyed to the depot of the Union Pacific Railway, which is a distance of one mile in Omaha and 1.8 miles in Council Bluffs, where they were then conveyed by train across the river, a distance of five miles. The Union Pacific at this time had about eleven trains in twenty-four hours, and part of these trains at night, after business hours were over for the day, thereby making the mail service so very unsatisfactory that the public began to clamor for the mail to be carried by the electric railway from the time the road was open. We finally made a contract with the Government to carry the mails between the two cities, and the public discovered at once that we were transporting these same mails from Council Bluffs to Omaha in the same time that it formerly took to deliver the mail by wagon from the Council Bluffs post office to the Council Bluffs depot, thus saving the time consumed by the Union Pacific train between the cities and time consumed by wagon from depot to post office in Omaha. In fact, the mail was probably in the hands of its owners and answered in some cases long before it had crossed the river by the old route. Or a man could mail his letter in Council Bluffs, walk to Omaha and wait for its delivery under the old system, while the new route makes it possible for him

[1]Read before the Amer. St. Ry. Assoc. Abstract.

Digitized by Google

to mail a letter when he goes to his office in the morning and get his answer by noon. No doubt an investigation will prove the same conditions exist in nearly every State in the Union at hundreds of places. This being true, we have shown the value of the service.

Now let us investigate the compensation. After it was discovered that the electric railways could handle the mails with so much satisfaction to all concerned, the managers of the railways thought they saw a great protection during strikes, etc., in the Government, and were ready to carry the mails at most any price, but I believe experience has taught us, through some of the strikes in the East, that they did not find the protection anticipated. The electric railway managers were figuring on the basis of what the Government had done for the steam roads during such troubles, and, while seemingly the comparison was a good one, it was erroneous from the fact that a mail car could be attached to an engine hauling ten or fifteen coaches of passengers, and this one train would perhaps clear up the traffic for hours, while with the electric roads, where the headway is anywhere from two to five minutes in large cities, where strikes are liable to occur, one train carrying the mail, which the Government would protect, would make no more impression upon a congested travel than would one drop of water in the ocean. It can be shown, therefore, that the only benefit received by the companies for carrying the mails on street and interurban railways is the compensation allowed by the Government for the same; hence the railways should work with an end in view to make this compensation enough to justify them in looking upon the carrying of mails as a profitable earning, and one which should receive their careful attention. It is true the Government has made some effort to arrive at the cost of carrying the mails, but in doing so, if you will read the report of the committee to the Postmaster General under date of June 25, 1896, which the Government at Washington will furnish you upon request, and which contains a great deal of valuable information, you will see the report treats mostly upon finding out what expense the railways are put to in handling the mail, and not upon how much the value of the same is to the public. This report makes an allowance of three cents per mile for carrying pouches upon electric trains, while in the same report they state: "The closed pouches upon the street cars should be compared with the Star Service, which it replaces," and in the same breath the Government states: "The Star Route service costs 4.94 cents per mile." Thus they recommend three cents per mile only for the electric service with its increased speed and more prompt and reliable handling, in fact, a superior service in every sense of the word. Following this statement they also say: "It is gratifying to report the improved service will not materially increase the expenditures of the Post Office Department."

Where the regulation wagon service in various cities is costing the Government 15.7 cents per mile traveled they only offer the electric companies 16 cents per mile for a 16-ft. car, and at the same time claim the service should be far superior, and that the car will take care of the natural increase for years to come. Does it not look unreasonable for them to dictate to the railway companies such terms when the service is so much superior to the wagon service? Why, in Council Bluffs they pay more for the wagon service to haul the mails to and from the depot, a distance of 1 8-10 miles, than they pay the steam road for hauling it from Council Bluffs to Omaha. Why? Simply because the steam roads are post roads and compelled to carry the mails as the Government dictates, while in the wagon route they are dealing with an individual, and it is impossible for them to make a contract for any such unreasonable terms.

When the Omaha & Council Bluffs Railway & Bridge Company first closed the contract with the Government for carrying mails between Omaha and Council Bluffs the Government allowed this company one hundred dollars per month, and was satisfied it was getting value received until other electric roads commenced to carry the mails more for protection than revenue. The Government then immediately took advantage of the time and opportunity to make an investigation, of which the report of June, 1896, was the result, which reduced our compensation to fifty dollars for nearly the same service. Had the American Street Railway Association handled this matter in the past, as general managers and passenger agents of steam roads handle their affairs, the result of the Government committee's investigation would have been different.

No doubt the companies spoken of in the committee's report to Postmaster-General Wilson, under date of June 25, 1896, as giving information as to the cost of carrying mails and operating mail cars, have since learned through experience that their estimates were entirely too low, although given in good faith at the time. The Chicago City Railway states that the revenue derived for running mail cars barely pays the expenses. Nearly every manager with whom I have communicated is dissatisfied with the remuneration.

It is not for me to say how much we should receive, but for the members of the association to take up the subject by discussion and work it out. This class of service is in its infancy; it will grow from year to year, and after a while be worth thousands of dollars to us annually, and what we do to-day and what we neglect is laying the foundation for the Government to work upon in the future. Then it behooves us to be on the alert and lay the foundation of the compensation so well that the Government cannot tear it down when the time comes for them to declare the electric railroads to be post roads.

Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use.[1]

BY RICHARD McCULLOCH.

BEFORE beginning a discussion of this subject, it would be well to define what is meant by single and double truck cars, as these terms are often very loosely used. In this paper a single truck car will mean one in which the body rests upon a truck, the axles of which are parallel with one another and at all times perpendicular to the centre line of the car. In a double truck car, the body is pivoted upon two independent trucks, each of which swings underneath the body with perfect freedom.

Double trucks for electric cars are of comparatively recent adoption. All of the early electric cars were equipped with single trucks, and in this, horse car and cable car practice was followed. As the single truck was first on the ground, and at present largely has possession of the field, it will be assumed that in this case of the double truck versus the single truck, the double truck is the plaintiff and must submit the weight of the evidence.

Double trucks were first applied to cars in the desire to use longer bodies than has been customary. In the use of a single truck the best practice has been to limit the wheel base to about seven feet, as a greater distance than this would cause the wheels to bind in curves. Assuming that the body of the car is twenty feet long and that the platforms project four feet beyond the body, the end of the platform would overhang the axle ten and one-half feet. This is as great an overhang as is customary, although single truck cars have been built with bodies longer than twenty feet. In this case it is necessary to provide extension springs on the trucks to check the oscillation of the car body. With a very long car body, however, the oscillation is not entirely overcome by this device, and the rocking becomes very disagreeable to passengers and very disastrous to the car and track. Twenty-two feet may be arbitrarily established as the limiting length of the body of a single truck car, and if we wish to use car bodies longer than this, we must adopt some truck which will avoid oscillation and which will pass around curves without undue use of power. The double truck accomplishes this, and it was to enable longer bodies to be used that it first came into use.

The truck which was first used for long street railway cars was an adaptation of that used by the steam railroads. This truck contains four wheels of equal size and is pivoted over the centre. It was soon discovered that for street railway use, this form of truck had two very objectionable features, first, that the floor of the car must be high enough above the rail to allow the wheels to swing freely under the car, and secondly, the motor being geared to one axle of the truck, only fifty per cent. of the weight of the car was available for traction. The latter is a serious objection on roads having grades.

From what has been said it will appear that the single truck is the truck for short cars, and the double truck is the truck for long cars. Therefore, a discussion of the relative merits of

[1]Abstract of paper read at the 17th Annual Convention of the Amer. St. Railway Association, at Boston, Mass.

Digitized by Google

these two types of trucks will involve a discussion as to the relative merits of short and long cars. Also, as it is customary to supply long cars with cross seats and short cars with longitudinal seats, we have instead of the comparatively simple subject of single trucks versus double trucks, which has been assigned to your committee, the more complicated struggle between the short car with single trucks and longitudinal seats, and the long car with double trucks and cross seats.

It will be assumed in the discussion which follows that the road possesses the characteristic city travel, a load curve of which is shown in Fig. 1. It will be noted that two very pro-

TABLE I.

Comparison of the cost of wheels and brake shoes on Double and Single Truck Cars for the year 1897.

	Average No. of Wheels used per car per year.			Cost per car per year.				Total Cost per car per year per 1000 passengers.	Wheel Mileage.	
	33"	33" Trailer.	24"	Wheels.	Labor in Replacing	Brake Shoes.	Total.		33"	24"
Double Truck Cars (47)	8.72		7.06	$77.98	$17.36	$11.70	$106.98	$0.47	17260	20916
Single Truck Cars (70)	6.26	1.00		$40.93	$7.99	$4.30	$53.22	$0.38	25329	

The Double Truck Car has four 33" wheels, four 24" wheels, and eight brake shoes.
The Single Truck Car has four 33" wheels and four brake shoes.
Average daily car mileage—115.

TABLE II.

Comparison of the cost of repairs and maintenance of trucks and motors on Double and Single Truck Cars for the years 1896 and 1897.

	Average passengers per car per year.	Truck Repairs.		Motor Repairs.		Total.	
		Per car per year.	Per car per year per 1000 passengers.	Per car per year.	Per car per year per 1000 passengers.	Per car per year.	Per car per year per 1000 passengers.
Double Truck Cars (47)	228000	$151.00	$0.80	$319.00	$1.41	$600.00	$2.21
Single Truck Cars (70)	141000	$110.00	$0.78	$196.00	$1.39	$308.00	$2.17

G. E. 800 motors on Double Truck Cars.
W. B. 80 motors on Single Truck Cars.

TABLES I. AND II.

nounced peaks occur in this load curve, one in the morning from six to nine and the other in the evening from five to seven. It is at these times that the capacity of everything is tried. While the load curves of all city roads resemble each other, it is evident that local conditions will to a large extent determine the kind of car which the railroad company will operate. Some of these local conditions are: The class of people who constitute the passengers, the location of the road with reference to the established lines of travel, the amount of pleasure travel received by the road, and the keenness of competition with other roads. The last is an important condition, because a road is sometimes forced to adopt certain measures for its protection which it would not adopt under any other consideration. In this discussion we will assume that it is to the interest of the road, even if no immediate competition exists, to use all reasonable endeavors to please its patrons, because this policy will render the road more ready to meet competition when it arises.

The expense of the average city road may be divided up as follows: Maintenance of way and structures, 4 per cent.; maintenance of equipment, 7 per cent.; conducting transportation, 52 per cent.; general expense, 8 per cent.; fixed charges, 29 per cent.

It will be noticed that the item "conducting transportation" is more than one-half of the total. This is largely made up of the wages of conductors and motormen, and is proportional to the number of cars operated. Hence, it follows that if we may by the operation of larger cars cut down the number of cars, this account may be reduced in nearly the same ratio as the size of the car is increased. There are many other reasons why the size of cars has been increased, such as the increased volume of traffic due to the higher speed and enlarged territory of the street railroads, the greater comfort demanded by the traveling public, the increased power available for the operation of cars, etc., but it is probable that the present tendency toward the increased size of car bodies is with a view of operating larger units and fewer of them.

A line operating small cars seating 28 persons on a headway of three and one-half minutes, would give the same service from a standpoint of seating capacity if it operated large cars seating 40 persons on a headway of five minutes. Manifestly, this latter service would be preferable from the railroad standpoint for the reason just given, and the question is, would the service be equally acceptable to the passenger. In this comparison we are assuming that the larger car is the more desirable vehicle in which to ride. Would the pleasure of the ride compensate the passenger for the greater length of time which he would have to wait? This is a question which must be solved by each manager for his particular road, as its correct solution depends largely upon local conditions over which he has no control. The scrutiny with which a passenger chooses a street car varies with the length of his proposed ride. If the ride is to be short he takes the nearest car without reference to comfort; but if he is to ride a long distance, he will walk past several lines in order to chose that one on which he will have the most pleasant ride. The car question then becomes a more serious one with long roads and with roads catering to a pleasure traffic. It has usually been accepted that on those roads having a purely business traffic, the proper car is the short one operated on short headway. The author, however, is of the opinion that even in this case, the long car, operated upon somewhat longer intervals, would be desirable. It has often been observed that where a line operates two sets of cars, a passenger will allow several cars to pass him in order to patronize that type of car which suits him best. This has been observed even in the busy hours of night and morning, when it would be fair to assume that passengers would be hurried and likely to take the first car which passes.

One of the most serious questions occurring in street railway practice is the problem of how best to take care of the rush of travel which comes morning and evening. With our present methods, there are only two ways of taking care of this travel: the first, by increasing the number of cars or units in service, and the second, by increasing the capacity of each unit. The latter method consists of attaching a trailer to the motor car, and where this is done, it is usual also to increase the number of units in service. On first thought there would seem to be no better method of increasing the capacity of a road than by the use of trail cars. They are easily attached and detached, they are in service only when necessary, and they do not require the assistance of additional train men. An examination of the trailer system, however, will reveal the fact that it possesses serious defects. The trailer is not automobile and requires the services of men and horses to attach it to the cars and to move it between the car sheds and the motor cars. The opening between the motor and the trail car increases the danger of accident both to passengers and conductors. The number of entrances and exits is increased, and this augments the work of the conductor in keeping track of his fares and increases the danger of his missing some of them. If an extra conductor is placed on the trailer to collect fares, a great portion of the gain during the trailer system is lost. The use of trailers throws an additional strain on the motors, as a heavy weight is added to the train which is not available for traction. The trouble is intensified as the load on the trailer increases; it makes the train more unwieldy in handling, and is largely responsible

TABLE III.

Comparison of the power required by Double Truck and Single Truck Cars.

	Average Watts.	Average Watt-hours per car mile.	Average Speed. Miles per hour.	Average Watts per seat capacity.	Average Watts per ton (car empty).	Average Watt-hours per car mile per 1000 passengers.
Double Truck Car. Seats 36—Weight 11.75 tons. Average for the entire day.	12040	1334	9.08	335	1025	5.9
Double Truck Car. Seats 36—Weight 11.75 tons. Average for the heaviest trip.	13080	1412	9.35	335	1085	
Single Truck Car—no Trailer. Seats 28—Weight 8 tons.	8471	921	9.20	302	1060	
Single Truck Car. Trailers operated 26% of the time. Average for the entire day.	9400	1110	8.42	234	1088	7.9
Single Truck Motor and Open Trailer. Seats 63—Weight 10.5 tons. Average for the heaviest trip.	12680	1440	8.84	201	1208	

TABLE III.

for the difficulty in starting and stopping quickly and in making schedule time.

To obviate the necessity of using trailers, a large car, equal in seating capacity to the combined capacity of the motor and trail car, may be operated. This system, however, introduces the disadvantage of the operation at all times of the day of a seating capacity needed only during a few hours of the day. It also increases the size and weight of the cars and the average power required to operate them.

In order to compare the relative economies of single and double truck cars, their advantages and disadvantages will be

Digitized by Google

discussed with reference to the following points: Wear and tear on trucks, wear and tear on motors, power required, wear and tear on track, the use of trailers, the seating arrangements and convenience of exit and entrance, the preferences of passengers. These relations will as far as possible be reduced to a money basis, and in order to do so a comparison will be instituted between a road which operates double truck cars and one operating single truck cars, using trailers 26 per cent. of the time to take care of the heavy night and morning travel.

Wear and Tear on Trucks.—It is evident that since a car equipped with double trucks has eight wheels and one equipped with single trucks has four, the former will be the more expensive to supply with wheels. Table I. shows the comparative replacement and cost of wheels and brake shoes on the two roads for one year. Table II. shows the comparative cost of maintenance and repairs of trucks and motors for two years. It will be noted that while the cost per car is much greater on the road using double trucks, the cost per passenger is always the same. It would not be fair to assume from these figures that the cost of maintenance of trucks and motors per passenger is almost the same, no matter what sort of truck is used, because these figures result largely from the fact that in this particular case the double truck car carries the greater number of passengers, but an inspection of the table will emphasize the advantage of the large unit as compared with the small one. It will be seen by a reference to Table I. that the greater part of the increased expense of maintaining the double trucks is due to the renewals of wheels and brake shoes.

In examining the relative strength of the various parts of trucks, the side pieces may be compared to a beam supported at two points and carrying a concentrated load. The deflection of such a beam is proportional to the third power of the span; and in the analogy, the span corresponds to the wheel base of the truck. Therefore, the shorter the wheel base, the stiffer the truck side, and in view of its long wheel bases, it is evident that the single truck is at a disadvantage in this respect. For instance, a truck side where the wheel base is four feet and six inches, is 3.76 times stiffer than a truck side of equal section where the wheel base is seven feet.

Wear and Tear on Motors.—Table II., to which reference has already been made, gives the comparative expense of inspecting, repairing and maintaining the motors of double and single truck cars. As in the case of the trucks, it will be noted that while the expense per car is much greater in the case of the double truck car, the expense per passenger is nearly the same.

Table IV. gives the relative weights carried by the different cars, when empty, seats full, and car crowded. It will be noted

TABLE IV.

Comparison of weights carried by Single and Double Truck Cars.

	No. of Seats.	Total crowded capacity.	Weight empty.	Percentage of weight on driving wheels.			Pounds weight per seat.			Pounds weight per unit of total capacity		
				Car empty.	Seats full.	Car crowded.	Car empty.	Seats full.	Car crowded.	Car empty.	Seats full.	Car crowded.
Single Truck Motor Car.	28	60	16000	100	100	100	572	702	943	200	246	330
Single Truck Motor Car with open trailer.	62	140	21000	70	67	67	394	468	622	150	210	300
Single Truck Motor Car with closed trailer.	48	125	21000	76	72	71	438	568	776	168	218	298
Double Truck Car.	26	110	22600	70	70	70	688	782	1050	214	258	344

* Note.—Each passenger is estimated at 130 lbs.

TABLE IV.

that while the percentage of weight available for traction in the case of the maximum traction truck remains constant, in the case of the motor and trailer it falls off as the number of passengers increases, and is especially small if the trailer is proportionately more heavily loaded than the motor car.

Power Required.—Table III. gives the power required to operate the different cars, and is the average of a long series of wattmeter tests. In making these tests, the wattmeter was placed on a car in actual service and allowed to remain throughout the entire day. An examination of the tables will reveal the fact that the power required for the propulsion of the car and the care and repairs which the motors demand are much greater in the case of the double truck car. But if the number of passengers be taken into account, it is seen that the power and the cost of maintenance are roughly proportional to the number of passengers carried with either style of truck.

Wear and Tear on Track.—The wear of the rails of a street railway track is due to the grinding action of the wheel on the rail, and this is proportional to the weight on the wheel, but is intensified by the dirt on the rail, which causes the wheel to slip and acts as an abrasive agent after the slipping has begun. The weak point of a street railway track, however, consists of the joints and the openings in the special work. The energy

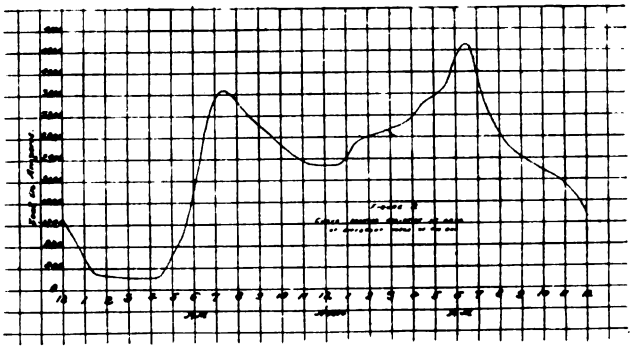


FIG. 1.

of the blow which the wheel strikes as it passes a low joint or a crossing is equal to the product of the weight of the wheel and the height of the drop. Therefore, on any given track both the wearing action of the wheel and the destructive action of the whels are proportioned to the weight which rests upon it. If the number of wheels under a car be increased, the number of blows which a low joint receives is also increased, but the intensity of each blow is diminished. Double trucks are at no disadvantage as compared with single trucks in this respect, unless the weight of the car be increased. Due to the shorter wheel base, double trucks go around sharper curves, and go around the same curve with less output of power and less wear on the rail than single trucks. The double truck fell into disrepute when the maximum traction truck was first exploited on account of its liability to leave the track. This was due to the small amount of weight which was placed on the small wheels. It is now customary to place thirty per cent. of the weight on the small wheels, and with track in fairly good condition, no difficulty is encountered in keeping cars on the track.

The Use of Trailers.—In the case of the two roads under discussion, the road operating single truck cars attaches trail cars to the motor car for two trips in the morning and two trips in the afternoon. For the entire year, trailers were operated on 26 per cent. of the trips. Allusion has already been made to the use of trailers. The advantage of the trailer on this particular road arises from the fact that the load peaks are unusually sharp. The use of the trailer increases the capacity of each unit during the heavy hours of morning and evening travel and during rush travel due to baseball games and races. On this particular road the motormen and conductors are paid ten cents per trip extra for all trips where a trailer is attached to the motor car. This expense largely offsets the value of this arrangement. There is no question but that the use of the trail car increases the number of accidents for two reasons; first, because the trailer is another car, and second, because the opening between the motor and trail car is a dangerous one for a passenger boarding or alighting from the car. It is impossible to estimate the money value of this accident liability, because in the case of many accidents it is difficult to determine what proportion of the damage was due to the trailer. Trailers must be switched at the ends of the roads and at the car sheds, and require men and horses for this purpose. The use of trailers also entails other expenses, such as car heating, cleaning, repairing and car license, which should be charged against the trail car system. To counterbalance all these disadvantages, the only advantage which the trail car system possesses is its flexibility.

The Seating Arrangement, Exit and Entrances.—As has already been stated, the cross-seat is used almost so universally in connection with the double truck car, that it is fair to consider the economy and efficiency of cross-seats and longitudinal seats in connection with the discussion. There is no doubt

Digitized by Google

that the cross-seat is preferable from the passenger's standpoint, and the reasons for this preference are not difficult to analyze. Passengers often travel in pairs, and the cross-seat gives a privacy to their conversation which is not possible with the longitudinal seat, the jerks due to the stopping and starting of the car are less disturbing to the passenger when he is seated facing the direction of motion, and the cross-seat renders it easier to look out of the windows.

If two car bodies of the same size are taken and cross-seats installed in one and longitudinal seats in the other, the car body equipped with the cross-seats will have the narrower aisle. This induces two disadvantages in the cross-seat car, one, that the crowded capacity of the car is less, and the other, that when the car is crowded, the time consumed in loading and unloading, is increased. The latter difficulty will be the more serious, the shorter the haul and the greater the number of stops.

In the early days of the double truck car, it was customary to mount the body high enough so that the wheels would swing under it. This gave the car a very unsightly appearance and made it difficult of access. Three steps were necessary to reach the platform, and as these steps were steep, this form of car was particularly objectionable to ladies. By the use of the maximum traction truck with 38-inch wheels, however, it is possible to lower the floor to within 37 inches of the rail. By dropping the platform 8 inches below the floor of the car, it is possible to reach the platform by the use of a single step 14 inches above the rail. This renders the car as easy of access as the single truck car. In the opinion of the writer, the fact that the car floor may be so low in double truck cars, is the chief advantage of the maximum traction truck.

It has been attempted to facilitate the loading and unloading of large cars by providing exits and entrances other than the rear door. This practice, however, brings about what is perhaps a more serious disadvantage as it gives the conductor more than one door to watch, renders it difficult for him to keep track of his fares, and increases the liability of his starting the car before a passenger is on or off.

The Preference of Passengers.—The preference of passengers to which allusion has already been made, is undoubtedly in favor of the double truck car. In cities where the entire street railroad system is controlled by one company, this point may not be considered of value, because passengers are obliged to ride in whatever conveyance the company chooses to furnish. However, the experience of roads which have changed their rolling stock from small, single truck cars to large, comfortable double truck cars, is that the travel has shown an immediate increase. Part of this increase has been drawn from parallel roads, but part has been a created traffic. As the accommodations increase, more people ride, and the regular patrons ride oftener. The street car ride, instead of being regarded as a necessary evil, comes to be looked upon as a pleasant part of the shopping expedition, the visit, or the picnic. How great this created traffic will be depends upon the class of patrons served by the road and upon the terminal facilities of the line. The extremes of society, the very rich and the very poor, are not good riders, and it is probable that a road serving either of these classes entirely would get very little return for additional accommodations. The greatest increase would come from those who are now the best patrons of the street railroads, the fairly well-to-do middle class.

In a general way it may be stated that the single truck car is more suitable for short hauls, dense traffic, many stops and low speed. On the other hand, the double truck car is more suitable for long hauls, high speed, few stops, and pleasure travel. In the existence of either extreme condition, it would not be difficult to decide which car to use. It is in dealing with intermediate conditions that the manager must use his judgment.

DISCUSSION.

In the discussion which followed the reading of the paper, Mr. McCormack, of Brooklyn, stated that on their heavy lines they have had between three and four hundred double truck cars and in not a single instance have they been able to lengthen out the headway. The double truck cars increase the patronage to such an extent that they have had to shorten the headway. When it comes down to standing loads and moving crowds, as on Labor Day, he noticed on the cars seating 40 passengers going to Coney Island that the average was 65 on the register. With a double truck car, and a seating capacity of 60, it is nothing unusual to see 128 or 130 on the register. There are 178 double truck cars running in the service on one line and one can imagine what the travel is on that line. The headway on the Court street line running from New York direct to Coney Island is less than a minute. On the Third avenue line it is three minutes nearly all day, and part of the time two minutes. The headway from Sixty-fifth street to Coney Island, where all the Coney Island cars converge, it is about twenty seconds.

Mr. John I. Beggs, Milwaukee: In the city of Milwaukee we have for three years been experimenting practically with the advantages and disadvantages of single and double truck cars. In 1896 there were put on the system 20 double truck cars with maximum traction trucks. These cars were equipped with 18 double seats seating 36 persons. A year ago, the early part of 1897, in view of our experience of a year in the use of the cars, we enlarged somewhat upon them, improved the trucks to some extent, we thought, by abandoning the maximum traction truck and so building the frame of the car as to in that way obviate what had been with us a very serious difficulty, namely, the forward wheels leaving the rail. We use 30-inch wheels to accomplish it.

Of course the question as to the use of the double truck car is determined by local conditions. Our double truck cars, for the climate of Milwaukee, are to a great extent a necessity. Because of the large open spaces and our short summer season, it is almost impracticable to maintain the duplicate equipment necessary for summer and winter service. I do not know any one now in the service of the company who has not been converted to the use of the double truck car, and we have arrived at a standard. We use a 33-inch wheel in our present equipment we are having built and still maintain only a distance of 32 inches from the rail to the bottom of the sill, and that was one of the difficulties we had to overcome. We are so thoroughly convinced as to the advantages of the double truck car that we are gradually permitting all our single truck cars to be worn out and scrapped as their life is brought to an end.

We have found that the use of the double truck cars has greatly increased the traffic; in other words, the people would wait for double truck cars on certain lines. We brought our average up within two years certainly a mile an hour. Our average speed now is somewhat in excess of 9 miles per hour. We would not be able to do that with a single truck car, because of the oscillating motion and the liability of the pitching to displace the trolley wheel, whereas with the double truck cars we seldom have such an experience. As to the matter of wear and tear, we believe the weight of evidence is in favor of the double truck car. We find that our repairs of springs is possibly 75 per cent. less on the double truck cars than on the single truck cars. We have been able to increase our headway on most of the lines on which we have placed the double truck cars.

As to the four motor equipment, I might say that during the present year we have had ten interurban cars constructed, running between Milwaukee and Waukesha Beach and the city of Waukesha, a distance of 26 miles, or slightly in excess. These cars were carefully constructed after complete investigation and the possession of all information we could get from electrical engineers, and based on this, and our own experience and judgment, we have equipped them with four 1,000 motors, geared to make 26 miles per hour, weighted with 40,000 pounds. Our double truck cars are possibly the heaviest in use anywhere in the United States. They weigh about 35,000 pounds. The latest improved truck permits us to use the 33-inch wheel with the same facility as the 30-inch wheel, with no greater height from the rail.

I can only say, so far as we are concerned in the city of Milwaukee, the double truck car has come to stay.

Test of Willard Third-Rail System.

The installation of the Willard third rail system of electric traction upon a two-mile section of the Long Island Railroad will be begun about September 20, to give a practical demonstration of the effectiveness and safety of this device. Railroad managers from all parts of the country will be interested in the tests to be made as soon as it is in operation.

Digitized by Google

Equipment and Maintenance of Electric Cars[1]—I.

BY M. S. HOPKINS.

WHAT is the best electric equipment to purchase and how can it be made to render the best service at the least cost? is the question which daily confronts the street railway manager, and one on which he is constantly seeking advice. There can be no answer which is applicable to all street railways, and no especial merit is claimed for the views set forth other than that they are the result of experience and born of repeated failures and successes.

CAR EQUIPMENT.

No fixed rule can be laid down for the selection of equipment, as climatic conditions, character of traffic, frequency of headway, conditions of roadway, municipal regulations and grades are all elements which determine what the equipment may or should be.

CAR BODIES.

For years car builders have attempted to devise a car body which would be equally durable in both summer and winter, but, judging from the character of equipment now in use on the majority of roads, such a car has not yet been produced. The combination car with movable parts is not satisfactory for winter use, is troublesome, noisy and cold, and is lacking in many of the essential features of the open car for summer service. The open cross seat car of the barge type, with running boards on the side, seems by far the most desirable type of car for Summer service, affording the largest seating capacity and the best facilities for receiving and discharging passengers, which is a great advantage in city service. Considering all features, the box car with side seats, large windows, wide end door to the side of centre, roomy platform and vestibules closed on one side, seems best adapted to the average condition of winter service. While the vestibule type closed on one side is not so convenient for the handling of large crowds, yet the additional safety afforded on double track roads should receive full consideration even at the expense of convenience. In localities where winters are accompanied with snow fall and freezing weather the vestibule affords protection to passengers, and motormen and conductors are able to render very much more efficient service.

The long car body seems to be growing in favor with the railway manager, due to the comparatively small increase in operation, in comparison to increased carrying capacity, and its allowing of the increase of headway or decrease in number of cars run resulting in a large decrease in operating expense per passenger carried.

The purchaser of car bodies should have a clear conception of the details of car construction, and specifications should clearly set forth the essential feature—minor details of interior finish and decoration being left to the manufacturer.

In the construction of box car bodies, the trusses should be as deep as possible, and great care taken to secure a perfectly rigid fastening at the end of the sill, as the slightest deflection throws an undue strain on joints and framing of car body.

Where side sills are plated on outside with steel plates, all season cracks should be thoroughly filled with a thick mixture of lead and oil, and entire surface given a heavy coat of oil paint before plate is put on. It is hardly necessary to say that all joints should be well leaded and protected from moisture. A heavy steel roof rafter in one piece should be put in at every post, and a saving in maintenance will be made by having platform floors of oak or maple. The trolley stand should be mounted on a trussed support, which will distribute the strain to the ends of car as much as possible.

Ash seems to be almost universally used in post and light framing of cars. This is probably due to the difficulty in securing the grade of oak necessary, the lighter weight of the ash and the greater ease with which it is worked. In spite of these difficulties, oak is far preferable, being stronger and more elastic, and will give a far longer life.

CAR TRUCKS.

Under average conditions a 22-ft. closed car or eight reversible seat open-car body should be the limit for a single truck. Although there are single trucks which will carry a longer body fairly well, yet the increase in maintenance will in most cases warrant the use of double trucks. The local conditions should govern the type of double truck used, the bolster type in most cases being preferable for long cars on high speed, suburban service, while for city service, where heavy grades and quick starts demand maximum traction, and short curves make it necessary for the wheel to turn under sill, the bicycle type must necessarily be used. This type of truck is no longer an experiment, and while they possibly require more careful inspection and adjustment, very efficient service can be secured from trucks of this type.

Trucks should be made up of a small number of parts, cast and malleable pieces should be the lightest consistent with strength. The springs should be so arranged as to prevent oscillation, and give an easy riding car under all conditions from no load to full load, and when the style of truck is of such design as to prevent the use of an under truss, the spring base must be exceptionally long and the end springs so arranged as to relieve the strain on the car sills.

The brake mechanism should be so designed that the strains will be equally distributed on all parts throughout its range of movement. The pins should be of ample size to provide for wear. The slider method of support for brake beam will be found more satisfactory than the loop support. The minimum amount of friction should exist between brake staff and shoe and release springs be as light as possible.

ELECTRICAL EQUIPMENT.

In the selection of the electrical equipment the main point is to secure equipment of ample capacity and proper design for the service required. In a railway motor the mechanical and electrical features which influence its maintenance should receive very careful consideration. The bearings should be large and lubricated by oil from below and cup grease from above, and so designed that the drip from the bearings will fall outside of frame. The armature should be so constructed as to permit the shaft being pushed out without disturbing the commutator and winding.

I am glad to note that the importance of light weight and slow peripheral speed of armature has been recognized in the recent design of railway motors. The inertia or flyweel capacity of the armature should be the smallest possible, consistent with the work required. Engineers differ as to the best method of suspension. From a theoretical standpoint the cradle or side bar suspension has the lead. The dead weight is largely removed from axle, thereby eliminating to some extent the hammer blow on rail-joints, decreasing the wear on axle brasses and securing the better alignment of gears; yet, in practice, the nose suspension is still preferred by the writer, as the car starts more smoothly—the weight of motor on spring supports overcoming the jerk and quiver so common in other methods of support. The specifications for railway motors, as drawn up by leading manufacturers of to-day, amount to practically nothing, and would suggest that the purchaser of motors in his specifications clearly define the rating heat limit and efficiency.

The series parallel controller is in most respects a satisfactory device, the chief objection being the narrow range of speed on running notches. Specifications for resistance should provide that the last two points of resistance be of sufficient capacity to allow of their continued use as running notches, especially where cars are operated in city service.

There are several types of magazine fuse boxes or cut-outs and single cut-outs using a special fuse, which possesses a number of points of merit. Without going into detail, it is the opinion of the writer that under average conditions the standard magnetic blow-out fuse box, using a link fuse, is preferable.

Each car should be equipped with a thoroughly reliable lightning arrester. The points to be noted in selecting this device are as follows: The kicking coil should always be installed; the air gap should be as small as possible; there should be a positive and quick device for interrupting the current after discharge, and one which will not be injured by discharge; there should be a non-inductive resistance in the main circuit which will limit the flow of current and thereby prevent the opening of the circuit breaker at the station when several arresters operate at the same time.

KANSAS CITY, MO. The Board of Park Commissioners proposes to install an electric fountain in the Paseo at Fifteenth street.

[1]Read before the Am. St. Ry. Assoc. Abstract.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 2, 1888.*]

Vol. XXVI. NEW YORK, SEPTEMBER 15, 1898. No. 541.

Echoes of the Street Railway Convention.

AN industry, the annual gathering of whose representatives serves to bring together close upon 1,200 registered attendants is an event of more than ordinary import. When to this number of people directly interested are added thousands of others attracted by an exhibition of apparatus connected with the industry, it may be claimed that the event is a notable one. Thus every year the electric street railway convention—for the horse as a factor in the street railway business is now an extinct species—gains more and more in importance and continues to absorb much of the brain and energy and capital of the country. The selection of Boston as a place of meeting was a particularly happy one, because it was the first large city in the country to equip its lines electrically, and its magnificent system of electric railroads of to-day, which was placed freely at the disposal of the members and their friends during the convention, attested fully the high perfection to which the art of urban electric railroading has been brought. Although Boston itself had nothing to offer in the way of conduit electric railways, it did have something superb to offer in the way of subways, and those who have not visited Boston since the opening of the latter can form but little idea of the tremendous benefit derived from the increased speed and general comfort afforded by these tunnels. The Boston Elevated Railroad surely deserves the thanks of the citizens of Boston for the magnificent piece of work undertaken for their convenience, and practically without a cent of expense to the city, which is more than reimbursed for its outlay by the railway company. Nantasket Beach, close by, showed what could be done in the way of third-rail construction.

Boston was most worthy of the occasion. The city itself presented so many attractions and the excursions to outlying points organized for the benefit of the members of the Association and their guests were so numerous that every hour was pleasantly occupied. Indeed, we are afraid that Boston has unfortunately set so high a standard of excellence in entertainment that few convention cities will be able to reach it in the future.

As to the papers read, it seems that those bearing on questions of finance or paying qualities of various operating devices and stimulants to travel aroused most interest and discussion. One of the most timely of these was the paper of Mr. Richard McCulloch on the "Comparative Earnings and Economy of Single and Double Truck Cars for City Use." The author pointed out that this question was dependent to a large extent upon the merits of long or short cars. He proceeded, therefore, to discuss the merits of the latter, and reached the conclusion that local conditions must to a large extent determine the kind of car which the railroad company should operate. Such local conditions are: The class of people who constitute the passengers, the location of the road with reference to the established line of travel, the amount of pleasure travel received by the road and the keenness of competition with other roads. As to the old question of trailers, their utility is still considered doubtful, as the trailer, not being an automobile, requires the services of men on the car and horses at the car barns. There were, however, questions on which the relative merits of the single and double trucks were directly dependent. These were the wear and tear on trucks and motors, the power required and the use of trailers, the seating arrangements and convenience of exit and entrance and the preferences of passengers. These are discussed in detail, and the final conclusion reached is that the single truck car is more suitable for short hauls, dense traffic, many stops and low speed. The double truck car, on the other hand, is more suitable for long hauls, high speed, few stops and pleasure travel. In the discussion which followed Mr. McCormack, of Brooklyn, made the remarkable statement that the double truck cars had increased the patronage of their lines to such an extent that they were compelled to shorten the headway. This was corroborated by Mr. John I. Beggs, of Milwaukee, who stated that every one in the service of the company has now been converted to the use of double truck cars and that they have arrived at a standard. Also, that the people would actually wait for double truck cars on certain lines, and that it was not possible to obtain an average speed of nine miles per hour with a single truck car because of the oscillating motion and the liability of the displacement of the trolley wheel. On the whole, it appears to have been brought out that a double truck car has decided advantages over the single truck car for city traffic, and wherever used it has come to stay.

The grievances of the electric railroad companies who have contracted to carry mail for the United States Government were ably voiced by Mr. W. S. Dimmock. With the unquestioned and admitted advantages secured to the Government by the trolley postal car, there is every reason for the street railway companies insisting on a fair and just compensation. Take the case of Boston, as mentioned by Mr. Sergeant, whose lines transported mail over 170,000 miles during the first few months of 1898, and to the amount of 100,000 pieces of mail matter a day, but the service only paid its running expenses. Mr. Beggs believed that there was very little profit in the mail service business for street railway companies, claiming that platforms were more advantageous for the accommodation of passengers than for the storage of mail pouches. We are glad to note that an efficient committee was apointed by the Association to look into this matter, and expect to see it accomplish good results.

Another interesting and timely topic on which a paper was presented by Mr. Walton H. Holmes, and which was ably and profitably discussed, was "To What Extent Street Railways Should Engage in Amusement Business." The consensus of opinion appears to be that this question is largely dependent on local conditions, such as the extent of area and population of cities, the climates, the tastes of the people and the nature of the surrounding country. In most cases it appears as if the companies have seen fit to charge a fare in excess of 5 cents to transport people to places of amusement established and kept up by the railway companies themselves. In addition to this, an entrance fee to the place of amusement is generally charged, and an extra fee for any special attraction within the garden itself. This latter was found to be expedient to ensure a profit to the company, if the places of amusement are owned and controlled by city authorities. It appeared to be the general belief that the promotion of amusement enterprises was a good method of stimulating business and that, while it might cause a congestion on a certain part of the line, this portion might serve as a feeder to the others. There was one point brought out in the discussion which was perhaps lost sight of by most speakers, or perhaps has fortunately not been brought to their attention, and that is the liability to accidents where so large a number of persons have to be transported to one place in a short period of time and the consequent loss to the company in the form of payment for damages. One of the speakers had two such cases to deal with recently, and is of the opinion that they have cut a great gash in the profit column of the amusement business. Summing up the matter, however, it appears as if the question is favorably looked upon by street railway managers, and that if properly handled large profits may accrue from this sort of service.

The paper by Mr. M. S. Hopkins on the "Equipment and

Digitized by Google

Maintenance of Electric Cars" showed that this question is one which requires a great deal of experience in order to be able to determine the best method of taking care of the equipment and ordering the best material for every branch of the service. He does not advocate the trip inspection of cars, as it involves unnecessary expense, requiring, as it does, the services of an inspector, who is necessarily a man of some ability, for each line of cars. Neither does he favor night inspection. The author does not believe in elaborate systems for the periodical testing of insulation, claiming that their value has not been fully demonstrated.

The question of inspection and testing of motors was ably treated by Mr. Fred B. Perkins, who has given this subject careful attention. In his opinion five men are required to attend to the inspection and care of twenty cars, two to do the greasing and inspection of motors, one to keep the controllers in repair, one to take care of the trolleys and assist in taking care of trucks and car bodies and one to have charge of the latter two.

A very exhaustive and helpful paper was that on the "Cost of Electric Power for Street Railways at the Switchboards, Both Steam and Water Power," by Mr. R. W. Conant, of Boston, who has made a careful study of the conditions present in forty-four power stations located at important street railway centres throughout the country. The aggregate capacity of these stations is 98,387 kilowatts, or 131,800 electrical h. p. He brought out the important point that the cost at the switchboard is now to be reckoned in kilowatt hours as the unit of power instead of horse power, which has hitherto been used.

The figures given by Mr. Conant in reckoning the cost of power and the fixed charges in central stations, as well as the method adopted by him for getting at the results, are of great value and importance and by far the most valuable which have come to our notice. They will certainly prove a great aid to street railway managers in the design, construction and economic maintenance of their power stations.

The Work and Needs of Our Patent Office.

IF it be true, as has been said, that the patent office is the pulse of a nation, then these United States must have been in a very healthy condition during 1897 judging from the report of that office which has just been issued. It teems with interesting figures which show that the inventiveness of this country is on the increase, but that the Patent Office is being managed on so economical a basis as to injure the great mass of inventors clamoring for protection and industries awaiting further development.

In 1897 there were received 45,661 applications for patents, which is a greater number than for any previous year in the history of the office. 23,729 patents were granted, which number was only exceeded in 1885, 1890 and 1891, the highest, 26,292, being reached in the last named year. The cash received was the greatest since the establishment of the office; the money expended, $1,122,843, however, being exceeded in several years. The receipts over expenditures was $252,798, and the total balance to the credit of the Patent Office in the treasury of the United States on January 1, 1898, was $4,971,438. Regardless of this laudable state of affairs, there has been no increase in the force or facilities for doing the work. The consequence of this is, as might be expected, that the work of the office is largely in arrears. The number of applications awaiting action December 28, 1897, was 11,382. Of these, 7,858 were applications which had not been taken up for examination. The first few months of 1898 have added largely to this already stupendous accumulation, and unless relief is given by Congress in providing additional force, the work will fall hopelessly in arrears.

It may be of interest to learn that the number of applications filed in 1897 exceeded by over two thousand the total number of applications filed in the twenty-four years from 1836 to 1860. In proportion to population more patents were issued in 1897 to citizens of Connecticut than to those of any other State, namely, 1 to every 786 inhabitants.

As a matter of comparison, it may be of interest to state that the number of applications in England during 1897 was 30,958, an increase of 765 over the number applied for in 1896, against 45,661 applications and an increase of 1,679 over 1896 in this country.

In submitting his report, Acting Commissioner A. P. Greeley makes a number of recommendations which if acted upon and passed by Congress, would greatly improve the efficiency of the office and increase its field of usefulness. The Commissioner's suggestions are timely and based upon years of active experience in the service of that branch of our Government, and therefore deserve careful consideration. Among these suggestions are the following worthy of special mention: "The Patent Office should command the highest order of talent, and no such body of men as compose the examining corps of the office can be anywhere else brought together for anything like the salaries here paid them. The corps is unsatisfactory only in numbers and permanence." He commends the classification of patents, such as is practiced by the English Patent Office, and says that no public money is asked for or needed for this purpose. The income of the Patent Office is ample for this and every other need. He urges the enlargement of the library so as to increase the efficiency of the search department, which is also inadequate in numbers.

The number of interferences brought before the chief examiner in 1897 was 815, which is additional work for this official and his four assistants, and the Commissioner is of the opinion that the Patent Office should be relieved of this interference work. It has not the proper machinery for conducting such proceedings. A bill providing for the creation of a court independent of the Patent Office for the trial of these cases is now before Congress and should receive favorable consideration. The British Patent Office publishes, in book form, abridgments of patents relating to the various classes of invention. Nearly every Commissioner of Patents for the past forty years has recognized and urged the necessity for the publication of like abridgments of United States patents. They would be of very great value not only to the examiners in the office and to inventors, but to the general public. He urges further, the printing of a larger edition of the official gazette, the expense of which would be but little more than the cost of paper and press work. These copies, properly distributed to libraries and other public institutions, particularly schools in which mechanic arts are taught, would be of substantial service to the public.

He deplores the condition of the scientific library, which, though perhaps unsurpassed by any similar library in the world, is yet far from complete and satisfactory.

As during the past year a number of the most efficient examiners of the office have resigned, because of inadequacy of salaries paid, the Commissioner hopes for speedy action by Congress to lessen or eliminate such occurrences in the future, by giving the men salaries commensurate with their abilities and duties. He touches further upon the necessity for a patent bar and upon necessary changes in the new patent law and laws regarding trade-marks.

A very interesting, though not quite up-to-date portion of the Commissioner's lengthy report is that dealing with the development of industries through patented inventions and the creation of new ones. He devotes entire chapters to the development of the electric railway, the telephone, copper wire and aluminum industries. He tells us that since 1880, 28,457 patents have been granted relating to electrical matters, which represents an income of just one million dollars to the Patent Office and about one and a half millions to the attorneys. Considering these vast amounts of money spent by inventors and companies for having their ideas and rights protected, it certainly seems reasonable to demand prompt action on the part of Congress for providing sufficient revenue to meet the growing and imperative needs of the Patent Office.

Let our lawmakers remember the words of the Hon. A. P. Greeley, that "it is to the stimulus to invention given by our patent system that the great increase in our exports is largely due, and it is on American invention, as fostered and stimulated by the patent system, that we may confidently depend for ability to maintain the high rates of wages paid to American workmen and yet compete successfully in the markets of the world with nations where the workman receives but a meagre return for his labor."

Digitized by Google

THE seventeenth annual meeting of the American Street Railway Association was held at the Massachusetts Charitable Mechanics' Association Hall, September 6-9, 1898.

TUESDAY, SEPTEMBER 6.

President Lang called the meeting to order at 11 o'clock and introduced Mayor Josiah Quincy, of Boston, who delivered an address of welcome.

The following were admitted to membership in the Association: Elmira & Horseheads Railroad Company, Elmira, N. Y.; Portchester Traction Company, Portchester, N. Y.; Portland & Yarmouth Electric Railway Company, Portland, Me.; Portsmouth Street Railway Company, Portsmouth, Va.

The President then read his address, an abstract of which follows:

We are to-day, for the seventeenth consecutive year, assembled in furtherance of the objects of our Association, under conditions most favorable to a pleasant and profitable meeting, for we are in the house of our father, the city of our birth. As the presiding officer of the Association and in the name of the street railway men of Boston, I bid you a hearty, sincere and joyous welcome.

As I trace the history of the Association from its inception I am convinced that its founders, in the words of Emerson, "builded better than they knew," for is it not remarkable that they should have chosen a name and set forth in our constitution the objects of the Association so wisely and well that no material change has been required to adapt them to present conditions, which are so radically different from those then prevailing. The constitution then as now says: "The object of this Association shall be the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street railways," etc.

The need for experimental knowledge in connection with a mule goes without saying, and statistical and scientific knowledge, with reference to harness, cars or strap-rails sounds very ancient as compared with engines, boilers, generators, girder rails, vestibuled cars, lightning arresters, ohms, volts, watts, amperes, etc., the familiar subjects of to-day. I do not mean, however, to belittle the value of the investigation, discussion and association of the earlier days, because there are too many veterans present (and I might myself be called one), who can testify to the great benefit derived therefrom. It does seem, however, that the necessity for holding meetings in different cities was greater formerly than now, for in order to know very much about what others had done or were doing we had to go to them, whereas now we can see almost everything in connection with our business in the room below, except the mercurial portion known as the State legislature, common council, tax gatherer and ubiquitous damage lawyer, so called.

The President then gave a brief account of the various meetings of the Association.

"I have thus briefly recounted our movements and spoken of the motives which it has seemed from the best information at hand prompted the Association in selecting its places of meeting, and the value of such selections and other reasons why the Association has grown to its present proportions and standing. Its growth and experiences, like all such organizations, have not been without some severe trials, but, unlike the prodigal son, we have wasted none of our substance in riotous living, but have improved at each successive step, and now reach home, not only the birthplace of the Association, but the home of the electrical industries in a larger sense, perhaps, than any other locality in the world. The people of Boston not only furnish money with a lavish hand to carry forward the work of developing the subtle power now so useful to us and all mankind, but also much of the brains and energy needed to make its use practical. Of this fact one circumstance will bear witness, and it is that Mr. C. A. Coffin, a Boston man, is still retained at the head of the largest electrical manufacturing corporation in the United States, if not in the world.

"In the growth and development of our Association and the business we represent let us not forget the priceless and unrivaled assistance rendered by the technical press. Without a spokesman, a guardian ever faithful to our interests as they have been, our progress would have been much slower and our pathway exceeding rough. All honor to these devoted publishers and editors.

"Nor must we for a moment forget (if we could) the indefatigable supply man, for he is the noblest Roman of them all. It is his courage, foresight and energy in taking up the new and useful article and pressing it upon our attention that helps to effect economies. We may sometimes be prematurely persuaded, but that is not the fault of the supply man; it is simply one of the arts of his trade necessary for us to learn. But, seriously, without them the meetings of our Association would be materially weakened and lose much of their interest and value. Let us, then, not fail to give them and their exhibits all the attention and examination time will permit.

"I desire to call attention to our fellow-workers and associates, the Accountants' Association, who hold their meetings simultaneously with ours each year, and are even now in session in another part of the building. The whole business of the street railway devolves around the accountant's office, and many of us can attest the value of having efficient persons in charge thereof. It is with the hope of enabling them to make their services more valuable to their respective companies that the Association was formed, hence they should receive every assistance it is possible for us to render. I bespeak for them your cordial co-operation.

"In closing I wish to thank our efficient secretary and the Executive Committee for their cordial aid and support during the year, and to assure the members of the Association of my great appreciation of the honor of being called a year ago to the office of president."

The report on the "Comparative Earnings and Economy of Operation Between Single and Double-Truck Cars for City Use" was then read by Mr. Richard McCulloch, the electrical engineer, Cass Avenue & Citizens' Street Railway Company, St. Louis, Mo.[1]

The report of the treasurer was presented, showing a balance on hand of $3,656.28. The Association has a membership of 161 companies.

It having been suggested that all the members of the Association who were present at the organization of the Association in Boston, in 1882, should rise, the following gentlemen arose: Messrs. W. Worth Bean, St. Joseph, Mich.; George B. Kerper, Dayton, O., and Julius E. Rugg, Boston.

Adjourned.

WEDNESDAY SESSION.

President Lang called the meeting to order at 10:30 a. m., and a paper was read on "Carrying of United States Mail Matter on Street Railways," by Mr. W. S. Dimmock, General Superintendent, Omaha & Council Bluffs Railway and Bridge Company, Council Bluffs, Iowa.[2]

Mr. Sergeant, Boston, in heartily endorsing all that the

[1]For abstract of paper see page 251. [2]See page 250.

Digitized by Google

writer had said, gave some interesting data of his experience in Boston. The trolley mail cars were inaugurated May 1, 1895, and the night service June 3, 1895. In 1898 the car mileage will aggregate 170,000 miles.

There were originally twelve stations, to which have been added one at Charlestown, January 1, 1897, and one at Roxbury Crossing, February 1, this year, on which date also a pouch service was established between Somerville and West Somerville. Connections have always been made with Boston & Albany and Providence depots, and Union station. Sixteen men are constantly employed, eight conductors and eight motormen. Out of about 45,000 trips run (to January 1, 1898), there were 360 failures or irregularities, or about 8-100ths per cent., and that was almost wholly due to the snow and the consequent blockading of teams in the narrowest streets. Seven cars handle 100,000 pieces of mail daily. The system is under the supervision of New England Superintendent of Railway Mail. In other cities the trolley and cable service is under control of the local postmaster. Each car handles nearly five and a quarter million pieces of mail, or a total of 36,561,170 pieces for the seven cars in a single year. Mr. Sergeant also agreed with the writer of the paper about the question of compensation, and thought that something might be done by the Association. He said: "We have never received a compensation here which has more than paid our running expenses. I think that any rate that should be fixed in an arbitrary manner, so much a car mile for carrying the mail, is entirely unfair. It all depends, it seems to me, on the conditions; what service is rendered, what the character of the service is, whether combined with passenger service or whether it is done with independent cars, and what the local conditions of expenses are."

Mr. Beggs, of Milwaukee, spoke of the preliminary stages of establishing a mail service through which his company is going at the present time. He did not appear to be enthusiastic over it, because of the fact that it did not seem to promise a profit and that the amount of protection that the various roads expected when they were established as mail routes, has not been of the advantage to them that they had hoped for. He questioned the advisability of carrying mail pouches on the regular cars of the system, saying that the platforms were too valuable to use to carry a mail pouch at three cents a mile, and it would very greatly inconvenience the patrons of the line, many of whom insist on using the platforms, whether one liked it or not. He further agreed with Mr. Sergeant that a committee of the Association should be appointed to take this question up with the Government for the purpose of having a fair rate of compensation.

Mr. Farson, of Chicago, after expressing views similar to those of the previous speakers, moved that a committee of five be appointed to act under the directions of the Executive Committee and communicate with the different members of the Association and get all the facts before them, keep the Association advised of their proceedings and that they have authority to confer with the Post Office authorities. This motion was seconded by Mr. Beggs, and carried.

Mr. Robert McCulloch, of St. Louis, stated that one of the roads in St. Louis made a contract with the Government to carry the mail and had two cars built especially for the purpose. They expected to derive a benefit by being able to designate the road as a U. S. mail route, and they had the inscription made on their cars, "U. S. Mail." As soon as the cars appeared on the streets, at the suggestion or interference of somebody, no one knows who, the Government required the sign to be taken off all the cars.

Mr. Dimmock, Council Bluffs, pointed out that the committee should keep that point in mind; it is in the power of the Association to dictate terms to the Government.

Mr. Payne, Milwaukee, expressed the belief that the trouble lay largely with Congress.

The Secretary then read the paper on "Maintenance and Equipment of Electric Cars for Street Railways,"[1] by Mr. M. S. Hopkins, electrician, Columbus Street Railway Company, Columbus, Ohio.

Mr. Sloan, of Chicago, in discussing the paper, stated that he did not utterly condemn night inspection. With them, he said, night inspection works quite satisfactorily for several reasons; the main one being that motor brushes were changed every night. It works well on the commutators and results in very little burning down of the commutators, and besides, a car cannot be overhauled too often.

Mr. Hawken, Camden, Me., said that he had noticed that the rear motor on the series point with the fields does about all the work, and the forward motor does very little. He knew of one road in particular that uses this point very largely, and they have a great deal of trouble burning out armatures, and he should like to know which was really the most efficient point in running the motors on series connections.

A vote of thanks was then tendered to Mr. Hopkins.

Mr. Ely extended an invitation to the members of the Association to attend the annual convention of the New York State Street Railway Association, which will be held at the Manhattan Beach Hotel on Tuesday and Wednesday, September 13 and 14.

An adjournment was then taken until 9:30 o'clock Thursday morning.

THURSDAY SESSION.

President Lang called the meeting to order at 10:30 a. m. An invitation was sent to the International Association of Factory Inspectors, which were in session at the House of Representatives, to attend the sessions of the Association and to inspect the exhibits.

The following paper was then read: "To What Extent Should Street Railway Companies Engage in the Amusement Business?" by Walton H. Holmes, General Manager, Metropolitan Street Railway Company, Kansas City, Mo.

Mr. Wyman, New Orleans, in opening the discussion, by request, expressed his positive belief that a strict railroad man should stick very closely to his line of work, and that he had very little freedom or time for going into the amusement business or any other sort of business that was not intimately connected with the daily operation of his cars, the management of his power plant and that style of business and methods that pertain specially and particularly to the working of his road. He said that he had found, however, that in a great number of cities this promoting of amusement enterprises was a very good method of stimulating the business of the company, and that Mr. Holmes was right in saying that it was a proper thing for the street railway companies to aid in the development of the municipal improvements like public parks, etc. Regarding the question of congestion of travel, he stated that they are always willing to have a good deal of congestion in running a street railroad. It is always to be remembered, he said, that if a resort at the end of some particular line should, for the time being, congest the travel upon that line, in a great many instances they used that line as a feeder to the others.

One thing we must always remember, he continued, that is that street railroad riding is, after all, a habit. As a habit it is growing.

Mr. Davis, Williamsport, stated that the experience in Pennsylvania among the small towns, is that the profits derived from the amusement business is not in proportion to the risk of the money spent, and in quite a majority of places, the rule being that it is almost impossible for the manager to separate the hot weather travel on amusement lines from the travel due to the entertainment or park itself.

Mr. Holmes, Kansas City, replied that as far as Kansas City was concerned, where they had the out-of-town parks, they had kept careful record of the business because they sell tickets to the park, and he would be glad to talk that over with anybody or send information.

Mr. Beggs, Milwaukee, stated that from his experience and observation in various cities, he did not believe that it paid a street railway company to go into the amusement business.

Mr. Harrington, of Camden, stated that they were making some money, but whether they would make the installation and furnish the park if they had to do it over again was a question.

Mr. Claflin, of Boston, speaking of the Norumbega Park, said that they had a very different experience from some of the gentlemen who had spoken. They have adopted the practice of charging an admission fee for the park and discriminate in favor of their railway patrons. Their railway carries its patrons a distance of five and a half miles for five cents. They sell on their cars for 15 cents a round trip ticket which includes admission to the park. People going on foot or bicycle are charged ten cents admission. The result is that the railway patrons get admission for five cents and the other people pay

[1] See page 255.

Digitized by Google

ten cents. The result has been that the park has maintained itself and costs the railway company nothing whatever for its maintenance.

President Lang, of Toledo, related a similar experience with a park on the lake shore. In addition to charging fifteen cents for the round trip and admission to the grounds, instead of giving free seats in the main park or body of the house, they put in reserved seats for which they made a charge of ten cents. They found that was working so well that they went into the gallery and put in reserved seats in the first two rows. There are also boxes that seat four persons which sell for twenty-five cents. The company found this last year that they came out a few hundred dollars ahead of the operating expenses, but they ran the casino company as an entirely independent company without any relation to the railroad company at all. It increased the earnings of the railroad companies about $40,000 last year. This year the casino company will net about $6,000, counting a fair depreciation upon the buildings, and the railroad company will increase its earnings over $50,000.

Mr. Wyman, New Orleans, gave some interesting details about a resort on Lake Pontchatrain, about six miles from the city. He said that they keep an accurate record of their operating expenses and receipts, and they find that their proportion of receipts to expenses varies little from the ordinary electric road.

Mr. Thompson, Muskegon, gave some interesting details about a park at Muskegon, and its pavilions and theatrical attractions. He was of the opinion that a good park with good attractions was a paying venture for a street railway company.

Mr. Cahoon, Elmira, spoke of the increased liability to accidents, and believed that the matter of damage suits and of the liability for damages that are incurred incident to the traffic increase should be considered.

Col. Heft, Meriden, believed that the street railway men of today have run mad on the question of amusements, providing everything without any recompense whatever, and if they were going to make these parks pay they must be run upon a business basis and an admission fee should be charged.

Mr. W. Worth Bean, the chairman of the nominating committee, then presented the following ticket, which was unanimously elected:

President, Charles S. Sergeant, second vice-president Boston Elevated Railway Company, Boston; first vice-president, Henry C. Moore, president Trenton Street Railway Company, Trenton, N. J.; second vice-president, Ernest Woodruff, president Atlanta Consolidated Street Railway Company, Atlanta, Ga.; third vice-president, Walton H. Holmes, general manager Kansas City Railway Company, Kansas City, Mo.; secretary and treasurer, Thomas C. Pennington, treasurer Chicago City Railway Company, Chicago, Ill. Executive committee, Albion E. Lang, president Toledo Traction Company, Toledo, O.; George E. Yuille, second vice-president of the West Chicago Street Railroad Company, Chicago, Ill.; Frank Jones, president Memphis Street Railway Company, Memphis, Tenn.; John I. Beggs, general manager Milwaukee Railway and Light Company, Milwaukee, Wis.; Ira McCormick, general superintendent Brooklyn Heights Railway Company, Brooklyn, N. Y. The next place of meeting will be Chicago, Ill.

The president then appointed a committee to look into the matter of the carrying of United States mail matter on street railways.

Mr. T. Y. Dzushi, Chief of Finance and Manager of Stores of the Imperial Government Railways of Japan, and Mr. K. Sugahara, chief engineer of the Kobi and of some street railroads soon to be built in Japan, being called upon, the latter addressed the convention briefly on the electric outlook in Japan.

The secretary announced the names of eight new companies that had joined the Association since the opening of the meeting.

A paper was then read on "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," by Mr. Frederick D. Perkins, electrical engineer Toledo Traction Company, Toledo, O. The paper was accepted with thanks and the meeting adjourned till next day.

FRIDAY SESSION.

The president called the meeting to order at 10:40 a. m. and a paper was read on "Cost of Electric Power for Street Railways at Switchboard, Both Steam and Water," by R. W. Conant, electrical engineer Boston Elevated Railroad Company, Boston, Mass.

On motion of Mr. Goff, Fall River, the committee on "Standard Rules for Government of Conductors and Motormen" was continued for another year and the sum of $200 was appropriated for its use.

On motion of Mr. McCormack, of Brooklyn, the thanks of the convention was given to the press of Boston for the intelligent manner in which they had written up the proceedings of the convention. The installation of the newly-elected officers was next proceeded with.

President Sergeant then addressed the convention and made a very happy speech.

On motion the convention adjourned sine die, to meet in Chicago in 1899.

Convention Notes.

THE entertainment provided for the attendants at the convention surpassed in scope and lavishness anything that has thus far, we believe, been attempted in connection with any of the electrical conventions, and, what is more, the manner in which the programme was carried out was worthy of all admiration. As a matter of fact, there was something to do or see from the beginning to the end of the convention.

On Tuesday afternoon a special train took a party of several hundred to Lexington, where a visit was paid to the Battle monument, and a short account of the memorable skirmish was given by the Rev. Mr. Staples, secretary of the Local Historical Society. A visit was also paid to the house in which Hancock and Adams stayed on the night preceding the battle.

Boarding the train again, the party was taken to Concord, and, entering 'busses in waiting, started on a tour, taking in all the points of historic interest in that beautiful old town. Among the points visited were the old Wright tavern, the homes of Emerson and Hawthorne and of Mr. Bull, orginator of the Concord grape. The battleground and the statue of the "Minute Man" at the bridge were also visited, as well as a number of other places of historical interest, and the tour was concluded by an all too short stop at the house of the local historical society, where many of the most interesting relics of the Revolutionary period were inspected.

It might have been supposed that this would have been enough for one day's pleasure, but not so. In the evening a reception was held at Revere Hall, with dancing, and a sumptuous collation was served later.

On Wednesday morning the ladies were taken to points of local and historical interest, being accompanied by a guide.

At 2 o'clock on Wednesday afternoon the members took the special cars placed at their disposal by the Boston Elevated Railroad Company from the Brunswick to the wharf, and boarded the boat for Nantasket Beach, passing through the beautiful harbor. The various beach attractions, including the chutes, served to while away the afternoon. Quite a large party, at the invitation of Col. Heft, boarded a special train on the Nantasket Beach Road, operated on the third-rail plan, and were taken quite a distance, inspecting the power house on the way. At 6 o'clock the members sat down to a clambake at the Ocean View House, and it was nearly 10 o'clock before the party were landed at their destination in Boston, special cars awaiting them at the wharf to take them back to their headquarters at the Brunswick.

On Thursday morning the officers of the Association, accompanied by the ladies, were driven on tally-ho coaches through the parks and through several of the finest residence streets of Boston, including Beacon street and Commonwealth avenue.

The convention adjourned somewhat earlier in order to prepare for the afternoon trip to Plymouth. Arrived there, special cars and coaches conveyed the party to the National Monument, commemorating the landing of the Pilgrims, and from there the party were driven to the celebrated Plymouth Rock, now housed under a beautiful canopy of granite, and many took the opportunity of stepping on this historical stone. After a drive about the town and the inspection of other landmarks, the party proceeded to Pilgrim Hall and viewed many of the historic relics of the "Mayflower" and its passengers. Refreshments were then served at the Samoset House, and toward 5 o'clock the party boarded the train for Boston.

In the evening the annual banquet of the Association was held at the Brunswick. The retiring president, Mr. Albion E. Lang, presided, with the incoming president, Mr. C. S. Sergeant, seated

Digitized by Google

at his right. The invited guests included Governor Wolcott, of Massachusetts; Mayor Quincy, of Boston; Mr. George G. Crocker, chairman of the Rapid Transit Commission, and a number of others. The after-dinner toasts on the menu were as follows: "Commonwealth," Governor Wolcott; "The City of Boston," Mayor Josiah Quincy; "Rapid Transit in Boston," Mr. George G. Crocker; "The New England Bar," Mr. Samuel J. Elder; "Orators and Oratory," Mr. Collins; "The New England Press," Mr. Stephen O'Meara, of the Boston "Journal." Governor Wolcott was unable to attend, but was represented by his private secretary, Mr. J. M. Perkins. Mr. Collins was also unable to be present. President Lang also called on Brig. Gen. W. A. Banker, first vice-president and general manager of the Boston Elevated Railway Company. Mr. Sergeant, the president-elect, being called upon by the president, made a few remarks expressing his thanks to the Association, and after a word of farewell by Mr. Albion E. Lang the banquet came to an end with the singing of "America."

On Friday morning the ladies were taken on a shopping trip, visiting the principal stores, and in the afternoon the members were taken on an excursion to Norumbega Park.

The exhibition, held at the Mechanics' Building, on Huntington avenue, was most representative of the art in every respect. There could be seen everything connected with an electric railway, from a track-sweeper to a trolley-hanger, and the exhibition being free, was availed of by thousands of visitors, including many of the employees of the Boston Elevated Railroad Company, who were particularly interested in all they saw.

So far as the arrangements for the comfort and convenience of the delegates and of the exhibitors went, there was nothing that could have been carried out in a more painstaking and satisfactory manner. The Association had established a Bureau of Information in a handsomely decorated booth in charge of Mr. Robert H. Derrah. In this there was a private telephone, stenographers, writing material and a post office. The uniform courtesy shown by all in charge of the Bureau of Information deserves hearty commendation.

The feature of the convention was the large attendance of ladies—no less than 500 ladies' badges having been issued.

The press, as usual, was fully represented. "The Street Railway Journal" had a large, handsomely decorated booth, with their beautiful monster convention issue displayed on the outer walls. "The Street Railway Review" occupied a booth adjoining the Information Bureau. Their convention issue also was a most admirable and artistic production. Among the electrical papers presented were the "Electrical Review," "American Electrician," "Electrical World," "Western Electrician," The Electrical Engineer and "Electrical Age." Representatives were also present of "Power," "Railroad Gazette," "Engineering News" and other journals.

Exhibit Notes.

A. O. NORTON, Boston, Mass., exhibited a full line of the Norton patent ball-bearing lifting jacks and the improved "sure drop" track jack, ranging in capacity from 8 to 70 tons, a new feature being a traversing or replacing jack for street railway service. Mr. H. A. Norton was in charge.

THE DEARBORN DRUG AND CHEMICAL CO. was represented by their Mr. Carr, who had a remedy for every ill to which boilers are heir. Mr. Carr also had a few pocket matchboxes as souvenirs for the company's friends.

OHIO BRASS CO., Mansfield, O.—The products of this firm include a full line of overhead material bell metal bearings, saddlery hardware and trimmings, engine trimmings, including sight feed oil cups and a large variety of brass trimmings. The exhibit occupied a handsomely trimmed booth to the right on entering the exhibition hall and remarkable in the number and variety of pieces exhibited. These included a full line of overhead material, including the flexible brackets of the Wood type, of which this company makes a specialty. A special line of materials for figure 8 trolley wire, clamps, special clamps for double trolley wire, and a line of acid and sulphur proof hangers for use in coal mine haulage. The exhibit included a large number of samples of the insulation known as the "Dirigo," of which they make a specialty; a great variety of ears for pull off lines, a special locking device, consisting of cap and cone form of hanger; type D hangers having scollops and specially designed catch, which prevents the cup from becoming loosened by vibration; feeder wire splicers up to 500,000 c. m. capacity; emergency splicers. Among the sundries we noted adjustable track brush holders and brushes, gongs, ratchet brake handles, snap switches, headlights, Eyanson quick brake switches, etc. Mr. C. K. King, secretary, and C. L. Wilkinson, special representative of the company, were in attendance.

GENERAL ELECTRIC CO.—At the end of the hall, where nothing intervened between the floor and the roof tree, an immense globe was erected by the General Electric Company to serve as an exhibit, not so much of its great facilities as of the world wide use of its apparatus. This company did not consider it necessary to make any special exhibit of its apparatus, as all the great dynamos now used to furnish current to drive the street cars of Boston were built in its works, almost every motor is of its manufacture, and with few exceptions, every switchboard and controller.

The huge globe, representing the earth, was built up of papier maché upon a frame work of wood, and rested upon a black pedestal picked out with gold. The continents and oceans were

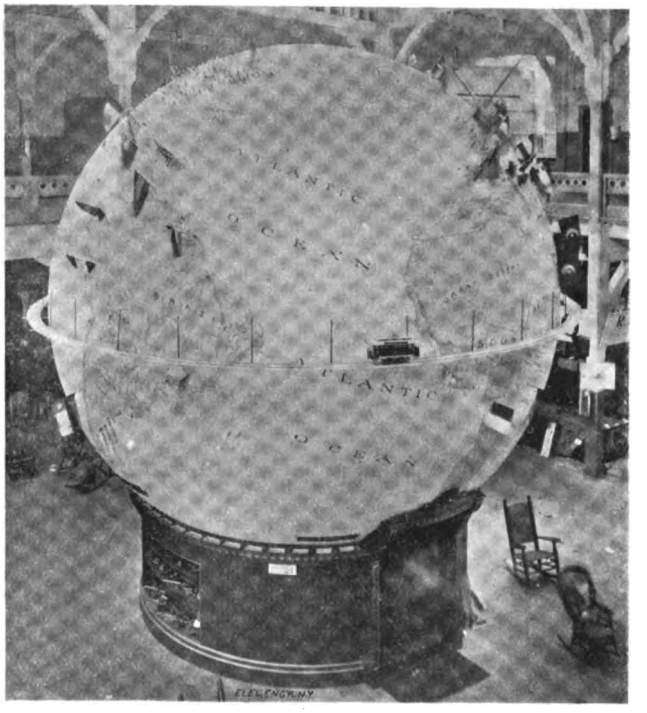


EXHIBIT OF THE GENERAL ELECTRIC CO.

plainly depicted by the scenic artists of the Boston Theatre. The globe was built in 54 distinct sections to a scale of 312 miles to the foot, was 25 feet 2 inches in diameter, and weighed 3 tons. It stood on a pedestal 16 feet in diameter, and was placed in exactly the position occupied by the earth itself in the interstellar space, the north pole being indicated by an incandescent lamp of 100 c. p. Two thousand seven hundred yards of papier maché, in nine layers of 300 square yards each, were employed in the construction of the globe, the building of which occupied just two months.

Dotted over the globe, thickly in the United States, less thickly in Europe, and sparsely in the less civilized countries, were small incandescent lamps of different colors, each lamp representing the location of some city in which the General Electric Company has some typical installation. Four hundred lamps were employed. The installations included those for street car propulsion for mill or mine work, or for lighting purposes. No better idea of the extent to which American ideas on matters electrical have permeated throughout the whole earth, could possibly be gathered than from a glance at this globe, and the mind reverted to the names of Edison, Thomson, Van Depoele, Sprague, Brush and others whose practical genius made this world-wide use of electricity possible.

Each country was indicated by its national flag, and the Stars and Stripes fluttered not only over the United States, but also over Cuba, Porto Rico and the Sandwich and Philippine Islands. The interior was richly upholstered, the decorative color

Digitized by Google

scheme being worked out in pink and green. The air was kept cool by electric fans and the lighting of the interior was all indirect. The globe will remain in place during the Mechanics' Fair, and will then be taken down and sent to Paris, where it will occupy a prominent position in the Electrical Building, at the Exposition of 1900.

The space behind the globe was set out with comfortable chairs for the benefit of visitors. Here also was set up a model plant to show the practical working of the Thomson car recording meter, consisting of a G. E. 800 motor, and R 11 controller and the necessary resistances, the car meter, fuse and a form M circuit breaker. The load was applied to the motor by means of a brake working on a pulley keyed to the armature shaft. Behind this plant was an instrument board, on which were exhibited the latest types of astatic volt and ampere meters, inclined coil switchboard and portable instruments, motor-vehicle meter and edgewise ammeter, all grouped around a type M station recording wattmeter reading to 8,000 amperes. On an easel a framed sign showed the railroads in the vicinity of Boston employing General Electric apparatus and the details of their equipment. Above the instrument board hung another illuminated sign—the complement of the globe—setting forth the railway record of the company, which has manufactured and sold up to September 1, 1898, 2,285 railway generators, aggregating 423,101 h. p.; 52,341 railway motors aggregating 1,270,865 h. p., and 50,000 series parallel controllers.

Let into the pedestal of the globe were two spaces fitted with shelves, on which were shown the most recent types of overhead material, circuit breakers, lightning arresters, etc. The entire convention hall was lighted from G. E. enclosed arc lamps.

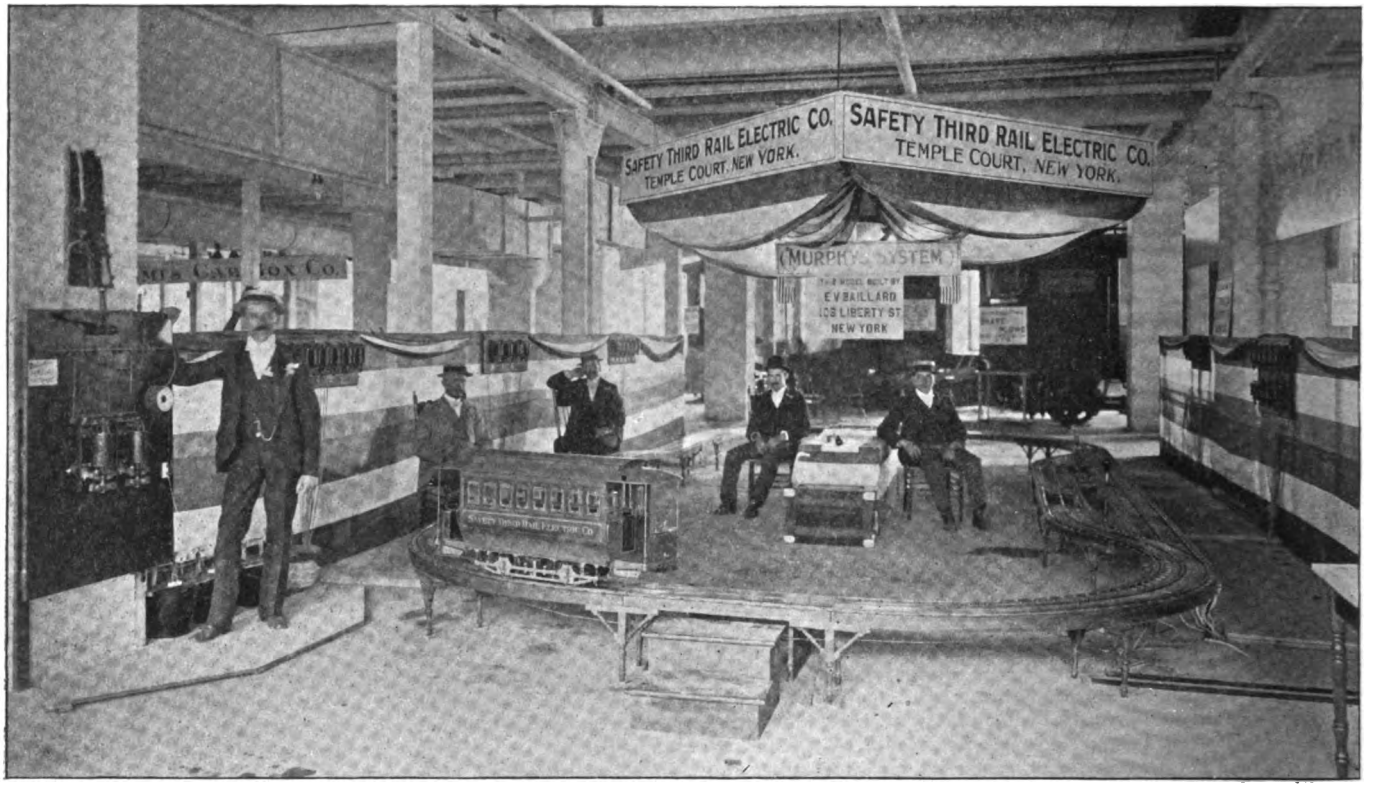
Headquarters were established in the Hotel Brunswick, where in the Venetian room several albums containing photographs showing the wide diversity of General Electric work and a fine collection of medals and diplomas were set on the tables.

Mr. W. J. Clark, general manager of the railway department, had the interests of the General Electric Company in his care, and no complaint was heard of its hospitality. Mr. Clark was assisted by the following representatives of the company: Messrs. C. B. Davis, F. M. Kimball, C. C. Pierce, C. D. Haskins, S. B. Paine, G. E. Steele, of the Boston office; R. H. Beach, T. Beran, J. J. Mahoney, T. A. Branion, W. G. Bushnell, of the New York office; Theo. P. Bailey, of the Chicago office; G. D. Rosenthal, St. Louis office; H. J. Crowley, Philadelphia office; A. D. Babson, Baltimore office; H. T. Heywood, Atlanta office. The Supply Department, at Schenectady, was represented by J. B. Lovejoy, general manager; H. C. Wirt, engineer, and J. K. Aitken. The Railway Department, by W. B. Potter, chief engineer; F. E. Case, E. D. Priest, L. C. Batchelder and C. A. Barry; the Patent Department, by A. J. McDonald.

BARNEY & SMITH CAR CO., Dayton, O., manufacturers of trucks and cars, exhibited three types of trucks, one being their well-known single truck and the others Class H, double motor truck and the maximum traction double motor truck.

DUPLEX CAR CO., New York and Boston, exhibited a complete car of the duplex type, manufactured by the Briggs Car Company, of Amesbury, Mass. This car combined the principles of an open and closed car, being changed from one to the other very readily. For converting it into an open car the side panels, including the sash and glass, are slid upward and housed under the roof. The exhibit was in charge of J. A. Lowell, president; W. B. Crittenden, vice-president, and Mr. George Moore, inventor and patentee.

THE SAFETY THIRD-RAIL ELECTRIC CO., New York, exhibited a model of their system, with car one-sixth size, operating on a circular track about 80 feet in length, with turnout, one section being immersed in a tank of water to show that the car can be operated should the track become submerged. The exhibit also included the non-arcing switches, by which the current is cut out or let into the active rail. A full description of this Murphy system appeared in The Electrical Engineer of April 7, 1898. Capt. John McLeod Murphy, Mr. E. V. Baillard, Mr. William Devoe, Mr. John Cokeley and Mr. G. Kahn were in charge of the exhibit.



THE SAFETY THIRD RAIL ELECTRIC CO.'S EXHIBIT.

AMERICAN VITRIFIED CONDUIT CO., New York. The exhibit included single, triple, quadruple and six-duct sections in different lengths, so that the joints are easily broken. There was also a section of multi-duct conduit laid in position as it appears in the trench on a concrete bed, with manhole construction and manhole cover, one section being undermined to show the strength of the joints. The exhibit was in charge of Mr. C. J. Field, general manager and chief engineer of the company.

SANITARY ENGINEERING CO., Philadelphia, manufacturers of ventilated manhole covers, specially designed for electric conduit service. These covers are provided with valves and grooves, which allow the air to escape but do not admit moisture under any conditions. The valves are operated by the passing of

Digitized by Google

vehicles, and as each one is located in a funnel-shaped cavity as they operate the interior air is discharged and drives the moisture from the receptacle. These covers are so designed that they may be filled with any kind of paving to correspond with the street. The exhibit was in charge of Mr. Alfred B. Botfield, patentee.

WALKER COMPANY, Cleveland, O. This company's exhibit included a three-panel four-circuit switchboard, equipped complete in every detail for street railway power house, a case

EXHIBIT OF THE WALKER CO.

containing separate parts of armature and commutator construction, representing a complete winding, one of partial winding and one with commutator attached and one with bare core; two styles of motors 33 S., with new type of solenoid controller; a 15 L. motor, two No. 5 motors mounted on the Peckham trucks, the whole mounted on a 60-foot section of the underground trolley construction of the Love type. The exhibit also included a large number of the Walker enclosed arc lamps for 110-volt circuit. Mr. S. S. Short, Mr. H. McL. Harding, New York representative; Mr. C. H. Black, Mr. J. A. Anthony, Mr. M. D. Law, Mr. H. G. Issertel, Mr. F. W. Sawyer, of the Boston office; Mr. H. B. Gay, of the Baltimore office; Mr. R. A. Byrnes, of the Buffalo office; Mr. J. Holt Gates, of the Chicago office; Mr. N. F. Moon, Pittsburg office; Mr. J. N. Dodd and Mr. J. D. Moore were in charge of the exhibit.

PECKHAM TRUCK COMPANY, Havemeyer Building, N. Y. This exhibit included twelve trucks, representing every variety of the Peckham system of trucks, and occupied the largest

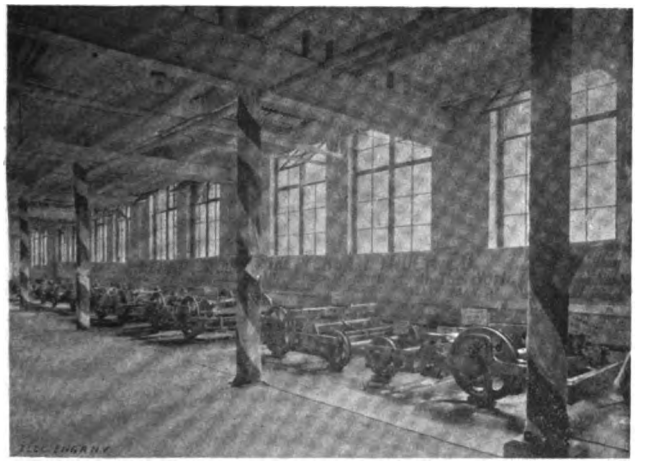


EXHIBIT OF THE PECKHAM TRUCKS.

space of any single exhibit at the convention. Some of the double trucks were equipped with motors of the Walker, General Electris and Westinghouse make. This firm are now making a specialty of their swing-bolster trucks for double truck cars, known as Type No. 14 A, No. 14 A extra heavy, No. 14 B short wheel base and No. 15. Besides the trucks the exhibit included an equaliizng brake shoe head, recently brought out by this company; also two types of maximum traction trucks known as No. 14 D 2 and No. 14 D 3. The exhibit was in charge of Mr. Edward Peckham, president; Mr. E. G. Long, vice-president; Mr. J. H. Hanna, manager; Mr. W. H. Gray, of the Chicago office; Mr. A. W. Field, of the Boston office; Mr. W. C. Rogers and Mr. George H. Bowers, of the New York office.

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Pittsburg, Pa.—This company exhibited a 25 k. w. rotary transformer, changing direct current into alternating current, small alternating motor with attached exciter, an exhibition of practical operation of lightning arresters, also pneumatic switch and circuit breaker outfits. These switches are operated by compressed air at a pressure of about 80 pounds and have 2,000 amperes capacity. The operating pedestal contains ammeter, voltmeter switch, rheostat controlling handle and operating valves. The compressed air is furnished by a 2½ h. p. rotary air compressor furnished by the Westinghouse Air Brake Company, and the motor by the Westinghouse Electric Company.

There were also shown three standard railway motors, 12 A, 38 B with side bar suspension, and the most recent motor, No. 49, 35 h. p.: also four controllers, the K 10, K 11, K 12 and B 4, the latter for operating the electric brakes; the latest type of iron-clad diverters, and a new auto-canopy circuit breaker. This has a magnetic blow-out, which is very effective. A standard street car choke coil, with lightning arresters attached, was also

EXHIBIT OF THE WESTINGHOUSE ELEC. AND MFG. CO.

shown, and lightning discharges through lightning arrester by means of a static machine.

There was shown for the first time a fan motor, which has not yet been put on the market, but will be the coming season, several of which were in operation in the exhibition hall.

The most attractive and interesting feature of the exhibit, and which received the most attention from the delegates, was a plate glass sign consisting of three sheets of plate glass 30x72 inches, placed one above the other, on which were the words, "The Name of Westinghouse is a Guarantee," the letters being about four inches high. The letters constituting these words formed one terminal of a condenser, and the back of the plates being covered with tin foil formed the other pole of the condenser. This sign was operated by the company's high tension transformer, with 200 volts primary to 60,000 volts secondary, the controlling device of course being in the low tension circuit. The effect was an infinite number of zigzag sparks from three to twelve inches in length, radiating from the letters in every direction and interspersed with extra heavy sparks that emitted forked lightning, producing a rushing and crackling sound loud enough to be heard all over the building. The power expended varied from almost nothing to 15 k. w. as a maximum. This apparatus was devised and patented by Mr. C. E. Skinner, of the Westinghouse Company.

There were also exhibited 12 alternating enclosed arc lamps, six indoor type and six outdoor. These were operated from an auto-transformer, which delivered any voltage from 80 to 4,000 volts in steps of five volts. In connection with this exhibit the

Digitized by Google

Sawyer-Man Co. had a full line of incandescent railway lamps of all candle powers and colors, the company being represented by Mr. Harry C. Farnsworth.

The Westinghouse Co. was represented by Mr. Frank H. Taylor, general sales manager; Mr. L. E. Imlay, Mr. W. M. Alexander, Mr. N. W. Storer, Mr. H. D. Murdock, Pittsburg, Pa.; Mr. Maurice Coster, manager Chicago office; Mr. Charles A. Bragg, manager Philadelphia office; Mr. Calvert Townley, of the Boston office; also Mr. A. S. Brown, Mr. H. M. Southgate and Mr. W. W. Ward, of the same office; Mr. H. C. Farnsworth, of the Sawyer-Man Lamp Co., Boston; Mr. J. R. Gordon, Atlanta, Ga.; Mr. T. C. Frenyear, Buffalo, N. Y., and Ahern & Soper, Ottawa, Canada.

PETTINGELL, ANDREWS CO., Boston. As agents for the Okonite Company this firm exhibited a full line of Okonite wires and cables. Also the "O. K." wire for the Phillips Insulated Wire Company. The exhibit included a reel of cable of 500,000 c. m., and a marble switchboard equipped with a full line of railway and stationary quick knife switches. There was also a board equipped with different colored lamps of the standard railway signal, a new block system brought out and manufactured by J. A. Lakin & Co., Westfield, Mass. Other features of this exhibit were a large pyramid composed of cans and cases of metal polishes known as the "Brilliant," and a sample of the Kilbourne sand box or sand feeder for street cars. The special feature of this feeder is that the sand is pushed into the tube by means of a rubber diaphragm, which is pressed outward by means of a foot lever operated by the motorman. The exhibit also included a line telephone inclosed in a metallic case, designed for use on high speed railways. The telephone is manufactured by Whitman & Couch, Boston. In addition a full line of overhead material manufactured by Macallen, of Boston; Lundell fans in operation, manufactured by the Sprague Company, and lightning arresters. The exhibit was in charge of C. B. Price, F. P. Price, J. E. Wilson, W. A. Peterson and W. J. Keenan.

EXHIBIT OF THE PETTINGELL, ANDREWS CO.

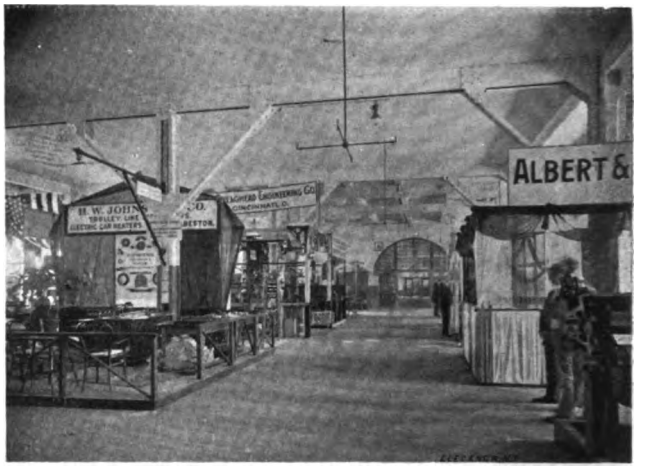
A. O. NORTON, 167 Oliver street, Boston, showed track and car jacks of the ratchet and screw type. These are manufactured from 8 to 70 tons capacity and in forty styles, making a specialty of their replacing jacks. Mr. Norton was himself in charge of the exhibit.

AMERICAN RAILWAY SUPPLY CO., Park Place, New York, made a fine exhibit of cap and breast badges, including samples of the police badges supplied to the police force of New York. Mr. Walter Chur was in charge of the exhibit.

THE AJAX METAL CO., Philadelphia, Pa. This firm make a specialty of car, engine and machinery bearings, and the exhibit included samples of Ajax metal in bearings of every description and ingots of different kinds of metals, including a superior grade of babbitt and solders. Also lead covering for iron roofs and lead covered bolts and nuts for use on refrigerator cars and such cars that are subject to the action of moisture or acids. Mr. George E. Pratt was in charge of the exhibit.

ALBANY LUBRICATING COMPOUND AND CUP CO., New York City, manufacturers of the Adam Cook Sons' original Albany grease and the Albany electric motor grease, exhibited samples in tin and glass cans. The exhibit was in charge of Mr. M. V. Peavey.

H. W. JOHNS MANUFACTURING CO., New York, exhibited samples of vulcabeston products for overhead and controller parts. Among the novelties was a new flexible bracket for side pole construction, the flexibility being gained by an attachment at the base of the brace. The exhibit also included a full line of car heaters of all the different types manufactured. The exhibit was in charge of Mr. H. C. Spaulding, of the Boston office, and A. Hall Berry, of the New York office. There were also representatives from the Hartford works.



EXHIBITS OF H. W. JOHNS CO. AND CREAGHEAD ENG. CO.

THE CREAGHEAD ENGINEERING CO., of Cincinnati, O., made their usual large exhibit of their well-known "flexible brackets." These brackets are the standard method of construction used on high speed suburban work and centre pole construction in cities, and were shown in a great variety of forms, both plain and ornamental for wood and iron poles, being made of a special steel which withstands a strain double that of ordinary pipe, and, all fittings being made in wrought and malleable iron, it is impossible to damage them by the most severe service. This exhibit also included a very complete line of overhead material, trolley insulators, curve pull-overs, section insulators, insulated crossings, strain insulators, pole tops, pole cellars, malleable iron crossarms and crossarm clasps, eyebolts, turnbuckles, etc. The display was nicely arranged and in charge of Mr. G. R. Scrugham, superintendent of the company. The company's souvenir was a neat steel pocket-rule and case.

SAMPSON CORDAGE WORKS, Boston, Mass., exhibited full samples of their solid braided cordage, making a specialty of their trolley and arc cords, of their well known "Spot" brand; also railroad signal cords, together with bell cord couplings,

EXHIBITS OF SAMSON CORDAGE WORKS AND ASHTON VALVE COMPANY.

Digitized by Google

socket snaps, cord grips and other fastenings. All the cords are treated with a waterproof finish, which insures long life. The exhibit was in charge of Mr. F. J. Coakley.

ASHTON VALVE CO., 271 Federal street, Boston, exhibited a very full line of Ashton pop safety valves and gauges, also water relief valves and cylinder relief valves, with a full line of pressure and vacuum gauges. Messrs. H. H. Ashton, C. W. Houghton and Albert C. Ashton were in charge of the exhibit.

GOLD STREET CAR HEATING CO., of New York, exhibited different types of car and office heaters, both stationary and portable, among the latter being a large upright heater with

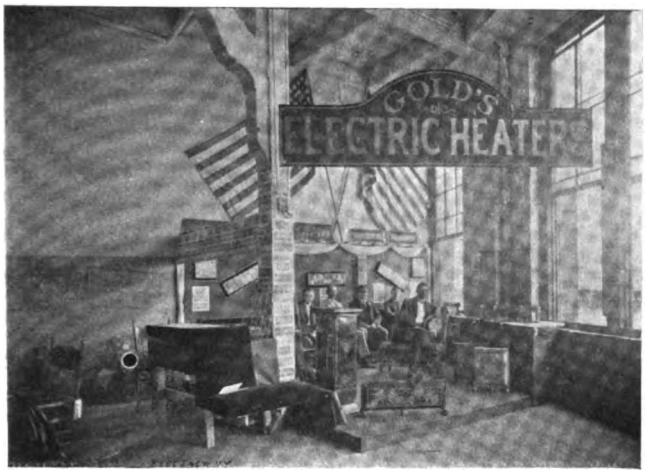


EXHIBIT OF GOLD ELECTRIC HEATERS.

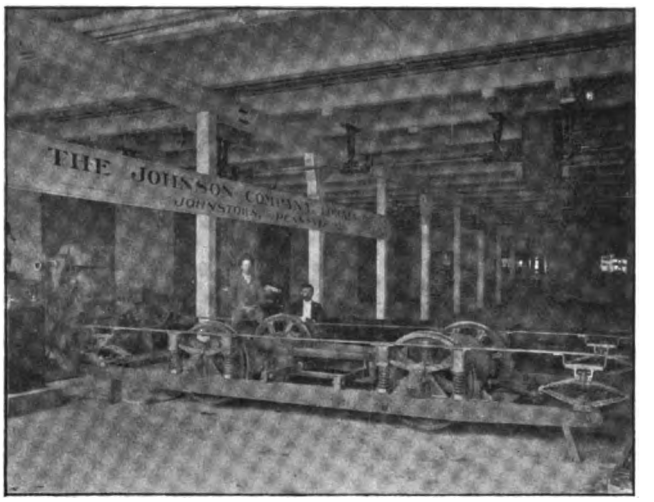
electric fan attachment for forcing the air through the resistance coils, designed to be operated from any line circuit. In the manufacture of these heaters the individual coils are supported by an enameled zig-zag rod. By this design the individual coils cannot become short-circuited and the wires cannot shift by the swaying action of the cars. These heaters are designed for three degrees of heat, which is regulated by a switch, so that in mild or extremely cold weather the required amount of heat can be secured without any serious loss of current. The exhibit was in charge of Messrs. E. E. Gold, J. E. Ward, E. H. Mossgrove and H. E. Beach.

ADAMS & WESTLAKE CO., Chicago, made a fine exhibit

EXHIBIT OF THE ADAMS & WESTLAKE CO.

of window shades, electroliers, headlights and a full line of car trimmings. The booth in which the exhibits were shown was modeled after a street car, with panels and windows of different widths on one side, double doors operated by different appliances at each end and one side of the booth showing only the posts, with curtains that come down to the floor, illustrating the use of these curtains on open cars. Among the novelties was what is known as the "Contra-Twist Double Door Hanger," consisting of an inch and a quarter bar placed above the door, with a right and left thread each way from the middle, by which means the doors are readily opened and closed and are held permanently in any position, from one-half inch to full width, and cannot be closed by the swaying of the car on curves. They also exhibited the "horseshoe rail bonds," manufactured by them. The exhibit was in charge of Messrs. F. B. Jones, H. E. Keeler, William Bartholomew, Louis Gray and E. H. Stearns.

THE JOHNSON CO., Lorain, O., exhibited two trucks of the Dupont type, one single of 30 h. p., and the other for double truck cars of 50 h. p., both equipped with the Johnson motors. There were also two 35 h. p. motors and their No. 44 trolleys. The trucks were so mounted that the wheels could be put in operation, showing the complete operation of the trolley and motors. Also a large number of samples of special track work,



THE JOHNSON COMPANY, LORAIN, OHIO.

including crossings and switches. The exhibit was in charge of Daniel Coolidge, president; H. C. Evans, New York; Randolph Clitzen, Boston; O. C. Evans, Cincinnati; W. W. Kingston, Atlanta, and J. A. Rutherford.

BIBBER-WHITE COMPANY, 49 Federal street, Boston, exhibited a full line of bracket arms and line material of their own manufacture, together with headlights, a full line of switches, single and double throw, manufactured by the Hope Electrical Appliance Company, Providence, together with the New Haven registers; also, a full line of commutator bars and rail bonds, known as the "protected" type and manufactured by the Forest

EXHIBITS OF BIBBER-WHITE CO., R. D. NUTTALL CO., CHAS. N. WOOD ETC.

City Electric Company, of Cleveland; also a full line of trolley wheels and harps of their own manufacture. One of the novelties was a corrugated trolley pull, which, because of the corrugation, possesses unusual strength, while it is lighter in weight

Digitized by Google

than any other type of pull, weighing ordinarily only about 12 pounds, as against 22 of usual types. Their line material was shown in two types, form "G" and "D." Form D is cap and cone type and is made up in galvanized and black enamel finish. Form G is made up in four different styles, black enamel, galvanized, bronzed and agatized. The latter is something entirely new in this line and is like the agatized dishes used in cooking materials. This material that goes on the parts is a perfect non-conductor In many cases it is not necessary to put in globe strainers, the insulation is so perfect. They also showed a full line of circuit-breakers and other goods manufactured by the Cutter Electric Company, of Philadelphia. They also exhibited two types of trolley bracket arms, one known as the "Adjustable Rigid," the other the "Adjustable Flexible," the flexible principle being secured by means of a strand of twisted wires attached to yokes, one at the end and the other at the middle of the arm. They had also telephone equipments for the use of the visitors. The exhibit was one of the most attractive of the entire show. It was in charge of Messrs. C. E. Bibber, president; A. L. Brown and David Dunn and Miss Anna Mendon, stenographer.

CHARLES N. WOOD, Boston, exhibited gears, pinions and bearings, manufactured by the R. D. Nuttall Co., of Allegheny, Pa., also trolley bases and poles, and trolley wheels manufactured by the same company. Mr. Wood, being New England agent for a number of manufacturing firms, had on exhibition goods representing the following: A full sample of registers, both stationary and portable, manufactured by the International Register Company; car heaters, manufactured by the American Electric Heating Corporation, of Boston; commutators for motors and generators of every description, of his own manufacture, and a track scraper, manufactured by the Monarch Stove Company, Mansfield, O. There was also a trolley pole, reel and catcher, manufactured by the Wilson-Thompson Company.

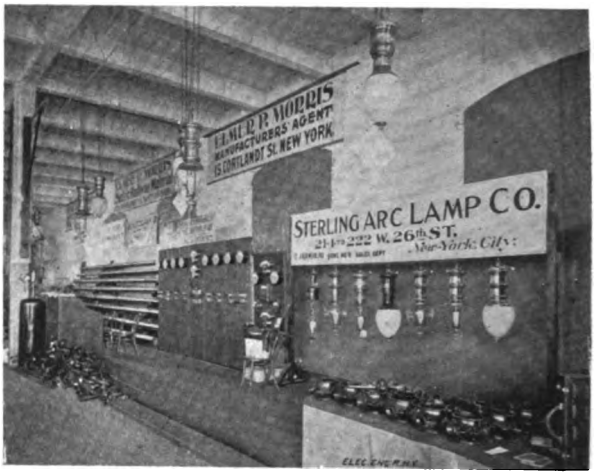
R. D. NUTTALL & CO., Allegheny, Pa.—The exhibit of this company, which was in connection with that of Charles N. Wood, included a very large number of gears and pinions of both cast steel and malleable iron, together with the trolley bases for different electric systems, also trolley poles and wheels and harps. The exhibit was in charge of F. A. Estep, president and treasurer; Chas. J. Mayer, agent for the Middle States; Geo. W. Provost, Pittsburg District; Edgar Newman, New Orleans; Arthur S. Partridge, St. Louis.

CROSBY STEAM GAGE AND VALVE CO., 93 Oliver street, Boston. This well known firm exhibited a full line of steam gages, valves, engine indicators, water columns and steam whistles. Among the specialties were specimens of spring

CROSBY STEAM GAGE AND VALVE CO.

seat, globe and angle valves; the special feature of these are the removable seats and discs. A marble gage board, including a set of four instruments—a clock, steam pressure gage, vacuum gage and revolution counter. Another specialty was a complete vacuum pump, with a mercury column, and the Crosby patent steam gage tester. The exhibit was in charge of Mr. Robert Pirie, the Boston representative.

ELMER P. MORRIS, of New York.—This exhibit included a full line of gears and pinions manufactured by the Simonds Manufacturing Co., of Pittsburg, samples of metals from Ajax Metal Co., of Philadelphia; three sizes Kosmic oil filters, manufactured by the Kosmic Oil Filter Co., of Easton, Pa.; eight different sized tubular side poles 30 feet long, made in various forms showing the construction of joints and patent lock swedge joint, manufactured by the Electric Railway Equipment Company, of Cincinnati. The exhibit also included a lot of grill



EXHIBITS OF STERLING ARC LAMP AND E. P. MORRIS.

work and bracket pole fittings, overhead material and car trimmings, manufactured by the same company, tapered steel trolley poles made by the Pittsburg steel trolley company, a lot of the Keystone Electric Instrument Co.'s meters, Sterling arc lamps, Garton-Daniels lightning arresters, Harrington Rail Bonding Co.'s system of bonding, Forest City Railway Co.'s protected bonds, Partridge Carbon Co.'s samples of carbon brushes, Christensen Air Brake Co.'s individual compressor and cylinder, which operated a whistle. Last, but not least, there was a miniature roof garden, with a trio of banjo artists, and over the door a suspicious looking placard which read, "Sterling X-Rays." The X-rays were absorbed without deleterious effects to any of the visitors, so far as we know. Mr. Elmer P. Morris was in charge, and Mr. Stevens looked out particularly for the Keystone Electrical Instrument Company.

STERLING ARC LAMP CO., New York City. This company exhibited twenty-six enclosed arc lamps of different styles and sizes, some of them being in use for illuminating other exhibits besides their own. There were five arc lamps in series for railway circuit, sixteen on low tension circuit, four alternating current. The exhibit was in charge of Mr. R. J. Randolph, general manager, and Mr. R. Schefbauer.

VACUUM OIL CO., Boston, exhibited a case containing samples of their various brands of oil. The exhibit was in charge of Mr. E. A. Record.

JOHN D. REED, Boston, exhibited several specimens of the Reed rail joint. This is a three-bolted double base bearing beveled point joint, designed especially to restore pounded out rail ends. In connection with the joint was shown an entire metal system for railway construction, including drain chutes and cross gage bars.

M'GUIRE MANUFACTURING COMPANY, Chicago, manufacturers of 47 different kinds of single and double trucks, sweepers and car heaters. The exhibit included their latest style Columbia four-wheeled truck and a number of different styles of their heaters, one being the improved magazine heater. The outside exhibit consisted of a combined sweeper and snow plow, known also as the Columbia, which is manufactured for the Chicago City Railway Company. The exhibit was in charge of Mr. W. J. Cook, vice-president, and Mr. W. G. Hubbard, chief engineer.

LAP RAILWAY TRACK CO., New York.—This exhibit was in charge of Mr. T. H. Gibbon, chief engineer, and included a section of track of wooden rails illustrating the method of construction and uniting of the rails in position. In this construction the rails are rolled in two sections, so that when

Digitized by Google

in position the head of one overlaps the other, the joints being strengthened by side braces and interior upright, the weight resting on the upright and making so many contacts that bonding is not necessary. This system is braced laterally by flat tie rods, which are notched into both sections and fastened by bifurcated keys.

WM. H. GALLISON COMPANY, Boston, exhibited a large globe valve.

THE J. G. BRILL COMPANY, Philadelphia, made an excellent exhibit comprising two cars, one being a 28-foot standard closed car, such as used by the Metropolitan Street Railway Company, of New York City, and which they have settled upon as a standard. It was mounted upon their No. 22 trucks of the maximum traction type. This car was finished inside in what is known as selected silver ash, with Millen patented signs, Sterling brakes and Sterling registers; the seats were upholstered in handsome Wilton carpet. The car had Brill's patented angle iron bumpers, radiating draw bars, etc., complete. They also showed one of Mr. John A. Brill's latest inventions, viz., a convertible car. This is a combination open and closed car, the panels and sash of which slide up by an ingenious method into the

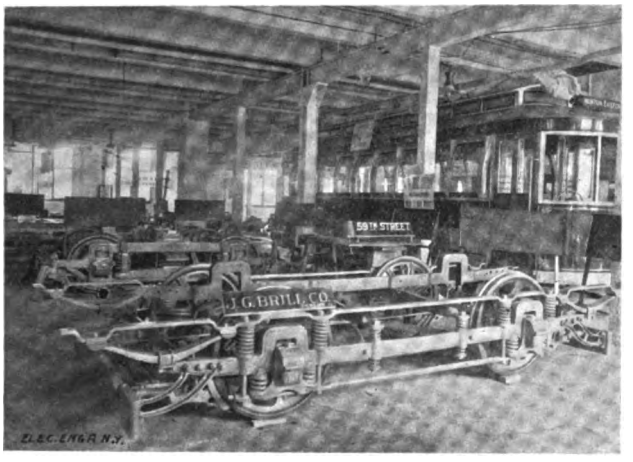


EXHIBIT OF BRILL TRUCKS.

roof without detracting from the appearance or shape of a standard closed or open car. The car has transverse seats, spring upholstered, covered with cane, decorated veneer ceilings, monitor deck roof, Brill's patented gates, radiating draw bars, pedal alarm gongs and angle iron bumpers. It was a pattern of car which attracted the attention of every delegate to the convention. There was also shown a Brill No. 21 E truck for single truck cars, being a non-pivotal truck with a solid forged axle box frame; Brill No. 27 perfect passenger truck, Brill No. 27 D truck, the standard truck of the Consolidated Traction Company, of Jersey City; Brill No. 27 F truck, a new pattern of trucks suspending the motors outside of the wheel base. In addition, they had on exhibition a Brill gate, radiating draw bar, sundry supplies, etc. In attendance were Mr. John A. Brill, Messrs. Samuel M. Curwen, George M. Haskell, George S. Hastings, W. S. Adams and W. H. Heulings.

WADSWORTH, HOWLAND & CO., Boston, manufacturers of coach, car and carriage paints and varnish, had two sides of their booth hung with different colored panels, highly varnished, and a pyramid of canned paints and varnish, the paints being ground either in japan or oil. Mr. H. A. Putnam represented the company at the convention.

THE INCANDESCENT ELECTRIC LIGHT MANIPULATOR AND CLEANER CO., Hyde Park, Mass., exhibited a device for cleaning and replacing incandescent globes where they are located out of reach. It consists of a pair of nippers operated by means of a flexible shaft. For cleaning, a mitten is placed inside the nippers. Mr. Joseph J. Dunn, manager of the company, was in charge of the exhibit.

AMERICAN MASON SAFETY TREAD CO., New York. This exhibit included samples of the Mason unwearable non-slipping stair tread, specially designed for car steps, running voids, car floors of open cars and stairs of all kinds. The material, which is manufactured in strips, consists of a base of steel ribs, with dovetail grooves, filled flush with lead, which is rolled in cold. Mr. John E. Walsh was in charge.

THE JANDUS ELECTRIC CO., of Cleveland, had a very attractive exhibit of their well-known enclosed arc lamps, and their series lamps on the 500-volt circuit attracted much attention. Their exhibit was in charge of H. T. Edgar, the New England agent, and the Creaghead Engineering Company, the central agents.

THE PARMENTER CO.'S LIFE GUARDS AND TRACK CLEANERS FOR STREET CARS, Cambridgeport, Mass. This concern exhibited a platform car, with tender in place, also wheel guard and track cleaner. The track cleaner is designed to remove snow and mud from the rail. Mr. George A. Parmenter was in charge of the exhibit.

HAM SAND BOX CO., Troy, N. Y., exhibited their No. 3 and No. 4 sand box, the latter being a modification of their well-known No. 1 box. In this the valve consists of a sharpened hoe, which pushes under the sand, and in drawing back hauls a certain amount into the tube. For use with this box sand does not have to be sifted. Mr. A. M. Wright was in charge of the exhibit.

POTTIER & STYMUS COMPANY, Lexington avenue, corner Forty-first street, New York, exhibited a reversible car seat, upholstered in cherry plush, especially designed for street railway service, arms being omitted. In reversing, the back turns over and rides at the same angle in either direction. The firm has recently contracted to supply the J. G. Brill Company with 1,050 seats in cherry plush. The exhibit was in charge of Mr. Frederick C. McLewee.

ALBERT & J. M. ANDERSON MANUFACTURING CO., Boston. This well known concern exhibited a full line of overhead line material, including a very large number of samples of the Aetna and Hecla railway insulators, Hancock and Ajax quick-break switches and "Ajax" lightning arresters. The exhibit also included enlosed arc lamps of the Monarch type and brass goods in drop-forgings and castings. Mr. Charles B. Pear was in charge of the exhibit.

COLEMAN FAREBOX CO., Tottenham, Ont. This company exhibited their portable farebox, which is provided with a handle and is carried by the conductor. He rings the bell by means of a thumb push-button. The box does not register the fares, but is burglar-proof and cannot be cheated. The hopper is provided with a system of steel teeth, which grasp the money or ticket as soon as it is partially inserted and prevents its being withdrawn. J. H. Coleman, one of the firm, was in charge of the exhibit.

BRADY METAL COMPANY, 100 Broadway, New York, exhibit consisted of street and electric car brass casting bearings and trolley wheels, Crowfoot and circular battery zincs. Three types of motor bearings were shown, pinion, armature and main axle bearings, with shell of brass and also of cast-iron, lined with genuine babbitt metal. Also check plates, anti-friction metals in pigs and Magnus metals in pigs. This metal has a record of running 426 miles in 425 minutes on a high-speed passenger locomotive without heating. The exhibit was in charge of Mr. D. M. Brady, Mr. C. P. King and Mr. C. M. Reubens.

WHEEL TRUEING BRAKE CO., Detroit, Mich. This company exhibited a new device for trueing up flat wheels while the car is running. It consists of a brake shoe made a little larger than ordinary shoes, of cast-iron, with chambers in the face of it, separated by an inch of solid metal. These chambers are filled with an emery composition, put in in a plastic state, which soon becomes very hard. In service the old shoe is removed and the emery shoe put in its place. The car is then continued in service and the wheel is ground down by the action of the shoe, a run of fifty to seventy-five miles being sufficient to true up a wheel, depending, of course, upon its condition. Dr. J. M. Griffin, president of the company, was in charge.

BEVERLY MACHINE WORKS, Beverly, Mass. The principal exhibits were their ratchet clutch brake handle and the ratchet clutch vertical brake wheel, the latter consisting of a double ratchet and beveled gear combined, and designed for service on vestibule cars. It has the ratchet principle, so that the brake may be set without turning the wheel clear round, maintaining the ratchet principle in all its operation and occupying not more than nine inches back from the dash. The concern also exhibited a full line of bronze car trimmings, including gongs, platform handles, bell-cord pulleys, door sheaves, sash locks and hinges, together with seat arms and backs. The exhibit was located in a prominent position and was in charge of Mr. John S. Baker, the proprietor, and Mr. William E. Bailey, superintendent of the works.

Digitized by Google

THE NEW PROCESS RAWHIDE CO., Syracuse, N. Y., manufacturers of rawhide pinions, were represented by Mr. A. C. Vosburgh.

BURDETT & JOHNSON, Boston. This exhibit embraced samples of cards with fancy and colored letters in great variety, and was in charge of Mr. A. F. Burdett and C. F. Johnson.

THE R. WOODMAN MANUFACTURING AND SUPPLY CO. This exhibit included conductors' punches, uniform buttons, speed indicators, car pushers and perforating machines. It was in charge of Messrs. R. Woodward and T. W. Wardley.

FORSYTH BROS.' CO., 1123 South Jefferson street, Chicago. This exhibit included car curtains and fixtures which the company manufacture in a great variety of material and figures. The samples were mounted in revolving and stationary cases and were in charge of Messrs. George E. Pratt and W. H. Forsyth.

SHAWMUT FUSE WIRE CO., Boston. The exhibit included a very large assortment of fuses of all sizes, from 1 to 1,500 amperes. The company also exhibited enclosed fuses for electric car heaters. Among the specialties were shown a number of knife switches. The exhibit was in charge of Mr. H. P. Moore.

EVANS ILLUMINATING CAR SIGNS, Portland, Me. Mr. W. R. Evans, the inventor, was in charge of this exhibit, which consisted of a revolving sign having three faces, each mounted on a pivot to the end frame in such a manner that the back face is always vacant, allowing the light from the car to shine through and illuminate one face.

COMPOSITE BRAKE SHOE CO., 620 Atlantic avenue, Boston, exhibited specimens of the composite brake shoes for steam and electric service, commonly called the "Compo" shoe. These are cast with round holes in the bases, which are filled with cork plugs or inserts. Mr. Frank Bruen, of Philadelphia, and Mr. W. W. Whitcomb, of Boston, were in charge.

NEW HAVEN CAR REGISTER CO., New Haven, Conn., exhibited all their different single, double and triple registers, so hung as to be operated by straps, cords and rods. The exhibit included the internal mechanism of a register still uninjured after having recorded 14,316,100 fares. The company was represented by Mr. Wm. M. Anthony, president; F. C. Boyd, vice-president, and J. S. Bradley, secretary and treasurer.

SHERBURNE & CO., Boston, Mass., manufacturers of construction tools and general railway supplies, exhibited a very large assortment of Buda improved track drills, rail benders, car replacers, track jacks, rail saws, hand and push cars, velocipede cars, etc. They are also selling agents for the Watson-Stillman Company, manufacturers of hydraulic tools and machinery, including jacks, rail benders, punches, etc.

CHARLES SCOTT SPRING CO., Philadelphia. The exhibit included all sizes of elliptical and spiral springs and sash and brush holder springs. The booth was surrounded by a chain of trolley pole springs in the national colors, hooked together. As a souvenir the firm gave out a small memorandum book, with handsome calf case and pencil and calendar for '98 and '99. The exhibit was in charge of Messrs. H. C. Johnston and D. S. Roche.

L. C. CHASE & CO., Boston, selling agents for the Sanford Mills. The exhibit included samples of all kinds of car plushes, plain and figured, showing a large number of designs for street railway seats; a case, showing samples of the different processes the mohair goes through from the time it leaves the goat's back until it is finished in the plush; also, a head and neck of an Angora goat as a wall ornament. Mr. F. B. Hopewell was in charge of the exhibit.

KNITTED MATTRESS CO., Canton, Mass. The exhibit included matting and cushions of different thickness, made of pure white cotton, knit into a netting or web, without any twist in the material, so that the natural softness of the fibre is retained, combined with great elasticity. In the manufacture of car cushions and backs the padding takes the place of curled hair. The exhibit was in charge of Mr. George Frederick Sumner, one of the principals of the firm.

SWIFT'S ILLUMINATED REVERSIBLE SIGNS, Boston. The signs exhibited by this company are mounted on a miniature car roof and so connected by shafts and beveled gear that the four signs can be revolved at one time by means of a short horizontal crank mounted under the hood. Each sign is provided with an incandescent lamp placed in a horizontal position in such a manner as to illuminate the outside face. Mr. W. H. Swift, patentee of the sign, was in charge of the exhibit.

THE HIPWOOD-BARRETT CAR AND VEHICLE FENDER CO., Boston, exhibited a small model of car with fender attachment. The exhibit was in charge of Mr. George Hipwood and J. W. Barrett.

A. B. HERRICK, 120 Liberty street, New York, exhibited a complete testing set for street railway work. This set was described and illustrated in The Engineer of September 8. Mr. Herrick himself was in charge of the exhibit.

RUSSELL CURVE-TAKING TROLLEY HARP, Watertown, Mass. This is a jointed harp, which allows the trolley wheel to cant over at any angle while rounding curves. The exhibit included a number of harps, and was in charge of Mr. W. H. Russell, inventor.

F. H. NEWCOMB, manufacturer of uniform caps of all types, was in personal charge of his exhibit. The hats on exhibition to the number of forty-two were in a neat double-deck glass case and were shown off to excellent advantage. The principal salesroom is at 13 Astor Place, New York, and the office and factory are located at 136 Flatbush avenue, Brooklyn.

PEARSON JACK CO., 64 Federal street, Boston. This firm exhibited samples of their 60-pound jacks of from 20 to 25 tons capacity. Also, the 30-pound jacks of two types, designed to work with either bar or ratchet, and which are made in different lengths, according to the height of the car to be lifted. These jacks are operated by means of a differential screw. Mr. A. H. Richardson and T. Edward Tuttle were in charge of the exhibit.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J. This exhibit embraced samples of such products as are suitable for use in street railway service, and included the noiseless wood grease for gears and pinions, the perfect lubricant, consisting of pure flake graphite, which, being mixed with grease or oil, increases the lubricating properties to a high degree, and is designed for use on armature bearings, air-brake parts and, in fact, all machinery. The exhibit was in charge of Messrs. A. L. Haasis, J. H. Baird, George E. Long and E. A. St. John.

THE PLASTIC RAIL BOND. Mr. Harold P. Brown, the inventor of the bond, and Mr. Charles H. Wilson, New England agent, were in charge of this exhibit, which consisted of a great variety of rails, bonds and appliances, which were shown in two large glass cases. The exhibit was located near the middle of the hall and receiced a great deal of attention. Not only the plastic bonds, but other types for particular conditions of rail, were also shown. The exhibit also included fishplates, with the bond attachment, that had been in service three years or more, and one that had been preserved intact after being under water for two years.

KEYSTONE ELECTRIC INSTRUMENT CO., Philadelphia, made a large exhibit of instruments, including ammeters and voltmeters. One panel of the exhibition board contained a sample of all the different types of meters manufactured and also a sample of the portable instruments for general testing work, the cases finished in nickel, brass and copper. Some of the claims made for these instruments are that they have no permanent magnets and no springs, so that there is nothing about them that can get out of repair or deteriorate. The exhibit was in charge of Mr. J. F. Stevens, president of the company.

STANDARD THERMOMETER AND ELECTRIC CO., of Peabody, Mass., made an exhibit of their "Midget" and enclosed arc lamps for all circuits. There were shown several designs of fancy covered lamps, which were used for lighting the gallery evenings on a 100-volt direct current system. Several of the lamps were fitted with large opal shades in place of the ordinary outer globe. It was particularly noticeable that the effect of a full-ground outer globe was pleasant to the eye without detracting from the efficiency of the light. The exhibit was in charge of Mr. M. L. Livingstone, assistant manager, and Mr. J. H. Hallberg, electrician and designer of the "Midget" lamps.

MEAKER MANUFACTURING CO., North Chicago, exhibited different types of portable and stationary registers, making a specialty of their new combination register, which combines letters and figures in the record and serves as an additional check on the conductor and bookkeeper, as the record must be interpreted from the key, which is furnished to the manager only. It also bars the public from knowing the business of the company. A new and handsomely designed pamphlet, illustrating and describing the register, was first presented at the convention. The booth was trimmed and decorated in the national colors. The exhibit was in charge of Mr. J. W. Meeker, president, and Mr. George Bean, vice-president.

Digitized by Google

CHARLES BACON, Boston, exhibited samples of non-slipping step covers, known as the Lyte steel and lead woven tread.

THE PANTASOTE LEATHER CO., New York and Chicago, exhibited Pantasote fabrics for curtains, upholstering and parlor hangings.

BROWNELL CAR CO., St. Louis, Mo.—This company made no exhibit, but was represented at the convention by Mr. F. B. Brownell.

AMERICAN RAIL JOINT MANUFACTURING CO., Cleveland, O., exhibited a full line of their malleable self-locking rail joint, designed for both T and girder rails. The exhibit was in charge of Mr. W. E. Ludlow and T. V. Church, the Western representative.

THE W. T. VANDORAN COMPANY, Monadnock Building, Chicago, exhibited the draw-bar of the same name; also a universal ball joint for draw-bar attachment and a draught appliance, which consists of a peculiarly designed spring that allows some flexibility in starting. Also a book of blueprints, showing in detail the nine different sizes of couplers manufactured by the company. Mr. Vandoran himself was in charge of the exhibit.

ROOKE REGISTER COMPANY, Peoria, Ill. A portable register of novel design was the principal exhibit made by this company. The register is a small, nickel-plated machine, with a hopper in the top, is carried in the hand and is provided with a lever, which is operated by the forefinger. As the passenger drops the nickel into the hopper the machine automatically registers and rings the bell; at the same time the hopper is closed. The conductor then presses the lever, which opens the hopper and prepares the machine for the next nickel. The exhibit was in charge of Mr. George F. Rooke.

CONSOLIDATED CAR FENDER CO., Providence, R. I., manufacturers of the Providence fender and wheel guards. The exhibit included eight fenders and a table exhibit of a large number of attachments such as are employed for attaching the fender to different styles of cars. Two of these were fancy fenders, designed for parlor and directors' cars, one being in bronze, the other white enamel. The third was the practical type, such as are now used on more than seventy street railways of this country, aggregating more than 6,000 fenders. The exhibit was in charge of Col. A. C. Woodworth, general manager; A. C. Woodworth, Jr., and G. H. Hale.

STANDARD UNDERGROUND CABLE CO., Pittsburg. The exhibit of this concern included samples of electric light cable and underground feeder cables for street railways. Also samples of submarine cable and patent telephone cables. A large number of samples were given out as souvenirs. The company claim to have filled the largest contract that was ever let in the world for feeder cable. This included an order amounting to $950,000, supplied to the Philadelphia Traction Company. The exhibit was in charge of Mr. T. E. Hughes, of Philadelphia, and Mr. George L. Wiley, of New York; also the treasurer of the company, Mr. Frank Reinhart, who was accompanied by Mrs. Reinhart.

CONSOLIDATED CAR HEATING CO., Albany, N. Y. This company made a fine exhibit of heaters designed for use under cross seats and side seats, together with regulating switches. An interesting feature of the exhibit was two heaters that have been in service on the cars of the Albany Railway since 1893. These heaters were in action and the voltmeter showed that they took exactly the same amount of current as when new. A bank of six heater cases was exhibited, in which incandescent lights were substituted for the heating coil and which were lighted in succession to show how the coils could be governed depending upon the weather, so that the consumption would be 3, 5, or8 amperes, depending upon the combination.

BILLINGS & SPENCER CO., Hartford, Conn. This company exhibited a full line of drop forged commutator bars, embracing about 200 specimens, among which was a specially large segment weighing 24 pounds, designed for one of the large Niagara Falls generators. The exhibit also included samples of the drop forged cases for the Lundell motors. The literature given out included two catalogues, one issued in September and devoted entirely to commutator segments for stationary machines, illustrating over 200 patterns of commutator bars. The other, a catalogue of commutator segments designed for all the standard street railway motors, both catalogues being very handsome publications. The exhibit was in charge of Mr. H. E. Billings, Mr. F. C. Billings and Mr. W. B. Post.

PAGE IRON WORKS, of Chicago, manufacturers of special work, exhibited photographs only. The firm was represented by E. S. Nethercut, engineer.

E. T. BURROUGHS CO., Portland, Me., exhibited in revolving cases a full line of their car shades and curtains with the fixtures. The exhibit was in charge of Mr. H. H. Russell.

THE WILLIAMS TRUSS JOINT RAIL CO., Chicago, exhibited specimens of the joint attached to T and girder rails. The exhibit was in charge of Mr. John H. Williams, inventor and owner, Boston.

THE BOSTON ARTIFICIAL LEATHER CO.'S exhibit included six railway cross and side seats covered with samples of their material in different colors. The exhibit was in charge of Mr. Walter N. Dole and Mr. Albert E. Prince.

F. H. THOMPSON, Portland, Me., exhibited samples of his car seat springs, known as Thompson's perfecting spring cushion, designed for carriage and street railway service. Mr. Thompson, the inventor and manufacturer, was in charge of the exhibit.

THE FOREST CITY ELECTRIC CO., Cleveland, O., exhibited samples of drop forged commutator bars and protected bonds, also a sample of insulating varnish, manufactured by the Sterling Varnish Company, of Pittsburg, Pa. The exhibition was in charge of John C. Dolph.

WEBER RAILWAY JOINT MANUFACTURING CO., New York, exhibited samples of the Weber joint, the particular features of which are that a wooden cushion is employed between the fish-plate and the rail. The exhibit was in charge of Mr. Richard Devens, engineer of the company.

MR. WILLIAM F. ELLIS exhibited samples of the continuous rail joint, the Sternberg bolt and the Goldie claw shoulder tie-plates, which are used exclusively in the construction of the Boston subway. Samples were shown of steel car axles manufactured by Dilworth, Porter & Co., of Pittsburg.

CAMBRIA IRON CO., Philadelphia. This exhibit included a full line of T-rails, girder rails, fishplates, guard rails and such material as is generally used in track work. There were drawings of a large number of rail patterns from 8 to 110 pounds per yard. The exhibit was in charge of Mr. W. A. Washburn, the New York agent.

BETHLEHEM FOUNDRY AND MACHINE CO., South Bethlehem, Pa., exhibited a new trolley base, the peculiar feature being that it has a double set of springs, which, in operation, are under tension instead of compression, which avoids any set in the springs. The exhibit was in charge of Mr. R. S. Bishop, New York representative.

THE STANDARD AIR-BRAKE COMPANY were represented by Mr. J. R. Ellicott, Mr. Bacon, Mr. Ball, Mr. McCutchin and Mr. Petty. No exhibit was made in the hall, but the delegates were invited to inspect their brakes now working very successfully on twelve cars of the Commonwealth Street Railway Company, of Boston.

ALLEN & MORRISON BRAKE SHOE CO. exhibited a new composition shoe that seems particularly adapted for street car service, giving a very high braking power and a very small wear on the tread of the wheel. The manufacturers claim that it is noiseless and prevents the wheels from skidding. The company were represented by Mr. T. V. Church.

J. P. SJOBERG & CO., New York, exhibited samples of street car woodwork, the specialty being a pair of pillars for closed cars provided with sash and blinds and showing their patent sash holders. The exhibit was in charge of Mr. W. J. Walker, formerly connected with the John Stephenson Company, and therefore well known to the railroad fraternity.

AMERICAN BRAKE SHOE COMPANY, represented by the Ramapo Iron Works. This exhibit included the "Diamond S" brake shoe, manufactured by the Ramapo Iron Works, consisting of a cast-iron body enclosing a bundle of expanded sheet steel strips. The exhibit was in charge of Mr. William F. Ellis, the New England agent, and Mr. F. W. Sargent, of Chicago.

JOHN F. OHMER REGISTER CO., Dayton, O., exhibited a section of car equipped with one of their classified registers designed to register eight different fares. The fares are not only recorded by totals in the register, but also are printed on a sheet within the register, which materially assists in the bookkeeping, as all possible reckonings can be made from the sheet, which is an additional tally on the conductor. This register is really a system of registry and bookkeeping. The exhibit was in charge of Mr. John F. Ohmer.

Digitized by Google

DUFF MANUFACTURING CO., Allegheny, Pa. This exhibit included four jacks of different sizes of the Barrett compound and lever track jacks.

THE ROCHESTER HOSE BRIDGE CO., Rochester, N. Y., exhibited samples of their folding hose bridge, the exhibit being in charge of Mr. Joseph P. McMahon.

McCARDELL, WEST & CO., Trenton, N. J., manufacturers of the Trenton trolley or tower wagon, showed a fully equipped wagon, Mr. McCardell being in charge.

MASSACHUSETTS MOHAIR PLUSH CO., Boston, exhibited a large line of plushes of different colors and figures, including the Boston Elevated Railway standard.

THE REED MANUFACTURING CO., Erie, Pa., exhibited an automatic self-adjusting pipe wrench of different sizes, working readily on any pipe from ½ inch up to 4 inches.

DE WITT'S COMMON SENSE SAND BOX, Lansingburg, N. Y. This exhibit consisted of two types of their well known boxes, Mr. De Witt himself being in charge of the exhibit.

WHEELOCK ENGINE CO., Worcester, Mass., manufacturers of the Greene-Wheelock engine. This exhibit included a plug, with valve system complete, for a 24x42-inch engine. Mr. Charles C. Hardy was in charge of the exhibit.

McROY VITRIFIED CLAY CONDUIT, New York and Chicago, exhibited samples of the multiple duct conduits as employed on the lines of the Metropolitan Street Railway Company, of New York. Mr. McRoy was in charge.

FALK MANUFACTURING CO., Milwaukee, Wis., exhibited a number of samples of the cast-weld joint, one a section of girder rail showing a joint after four years of service. The exhibit was in charge of Messrs. E. A. Wurst, Clement C. Smith and H. L. Prather.

THAYER & CO., Boston, represented the Aultman & Taylor Manufacturing Company, Mansfield, O., manufacturers of horizontal and vertical water tube boilers of the Cahall type. The exhibit included a header cast from flowed steel and a swinging manhole plate, together with drawings of the boilers.

CORNING BRAKE SHOE CO., Buffalo, N. Y., exhibited samples of their brake shoe, the principal feature being that the centre is an irregular mass of soft iron, which is cast first and the body of the shoe molded around it. The exhibition was in charge of Mr. Francis Granger, Eastern sales agent, and H. T. Mercur, general sales agent.

METHUEN ELECTRIC CO., Methuen, Mass. Samples of the company's new insulating connections were on exhibition. These are designed for connection between the motor and car wiring and take the place of the cumbersome method of soldering and taping, the connections being broken and restored in a very short time. The exhibit was in charge of Mr. C. D. Holman.

WM. H. BAILEY, Boston, New England agent for the Tonkin patent internally fired water tube boiler. The exhibit included a stationary boiler mounted in the power room of the Mechanics' Institute Building. After mounting the boiler was tested and a record of the test published in the circular given out at the Convention. Mr. Bailey was personally in charge of the exhibit.

BOARDMAN-TUCKER CO., Boston. This exhibit included special telephone apparatus designed for street and steam railway work, a special feature being a line telephone fitting in a cast-iron weather-proof case, designed to be attached to a pole along the line and containing all the necessary appliances; also others for office and desk work. The exhibit was in charge of Mr. A. F. Boardman.

WAGNER ELECTRIC MANUFACTURING CO., St. Louis. The exhibit included illuminated dial, dead-beat indicating instruments, a new line of carbon brake switches, two patterns of the standard Wagner transformers, Type F and Type G; also photographs illustrating some of the largest switchboards that have been manufactured by the company. Mr. E. H. Abadie, of St. Louis, and Mr. H. M. Mayo, of the Boston office, were in charge.

STERLING SUPPLY MANUFACTURING CO., of New York. This exhibit included a full line of fare registers known as the "Sterling," one of the latest being a double register on which two fares or tickets and fares can be recorded. Also a full line of overhead insulating material, safety brakes, the Sterling sand box and fender and a large number of drop forge commutator bars. Mr. F. A. Morrell and Mr. L. D. Nelson were in charge of the exhibit.

HEYWOOD BROS. & WAKEFIELD CO., Boston, exhibited car seats, both single and double, rattan hand sweepers and brooms; also a sample of the crude rattan used in the manufacture of snow sweepers. The type of seat exhibited is known as the Henry seat. The exhibit also included cocoa matting designed for car floors and cane webbing for car seats. Mr. Fred H. Henry and Mr. Clifford L. Lougee were in charge.

DUQUESNE FORGE COMPANY, Pittsburg, Pa. The exhibit of this company included a full line of forged gears. These wheels differ from all other railway gears in that the rim is forged or rolled straight in the form of a channel beam, after which they are bent to a half circle, when cast spokes are attached and the teeth are milled in the surface the same as in the manufacture of cast gears. The exhibit was in charge of Mr. J. B. Van Wagener, of Pittsburg, selling agent.

BEMIS CAR BOX CO., Springfield, Mass.—This exhibit included a standard single truck and their No. 37 pivotal double truck. The special feature of the truck exhibited is the long elliptical spring at the ends, which increases the spring base without lengthening the truck. The feature of the double truck is that the car is mounted low without having to cut out the running board. The exhibit was in charge of Mr. Geo. M. Hoadley, general manager, and Edward N. Richards, superintendent.

STANLEY & MILES, Whitman, Mass., exhibited their emergency brake as designed for street cars, the particular feature of which is an automatic appliance for emergency stops. By pressing down on the end of the handle a spring is released which applies the brake. For ordinary stops the handle is used as with other crank brakes. Another feature of this brake is that no chain is employed, but the power is obtained by means of a screw through a bell crank lever. The exhibition was in charge of Mr. J. E. Miles.

ROCHESTER CAR WHEEL WORKS, Rochester, N. Y., exhibited steam and street car wheels loose, mounted on special stands, also several types of wheels mounted on axles, including wheels of 15 to 40 inches in diameter. The particular feature of these wheels is that they are cast in the bar contraction chills, after which they are machined. The 40-inch wheel is specially designed for electric locomotive service. The exhibit was in charge of Mr. Frank D. Russell, Mr. George C. Morse and Mr. A. H. Strickland.

WM. WHARTON, JR., & CO., of Philadelphia. This company's exhibit included frogs, switches and mates and other special goods generally known as manganese steel special work. The unbroken main line cross-over was also a special feature of the exhibit. Another special feature of the exhibit was the Pennsylvania Railroad standard three-rail crossing. The firm was represented by Mr. Wharton, Mr. Howe, Mr. Angirer and Harrington, Robinson & Co., New England agents, Mr. J. B. Robinson being in charge.

COLUMBIA MACHINE WORKS, Brooklyn, N. Y., exhibited a line of commutators, made up from their own drop forged bars, car trimmings, journal bearings, pinions and gears. Among the specialties were their adjustable controller handle, the particular features being that it is always tight on the spindle and prevents the wearing of the spindle, thus giving always a positive motion. Among the specialties in overhead work was a 4-point pull-off or anchor, so designed that should the trolley leave the wire it cannot possibly catch the guide on either side. The exhibit was in charge of Mr. W. R. Kerschner, selling agent; Mr. J. G. Buchler, senior member of the firm, and Mr. J. W. Grady, superintendent.

NEW YORK CAR WHEEL WORKS, Buffalo, N. Y., manufacturers of machined car wheels for steam, electric and cable service, had a number of standard electric wheels mounted on their special cold rolled axles and loose wheels of various sizes and types. A new style of wheel was shown for interurban service where cars run at high speeds, the wheel being made with a single plate instead of with open spokes. The company also had several loose axles of special quality, of which they furnished some 10,000 for electric service. Also standard 1-inch test bars for showing the transverse strength of the metal in the wheels, and their chill test pieces, which give depth and hardness of chill, together with the sections of the tread and flange of the various sized wheels. The exhibit was in charge of Mr. J. J. Granger, of New York; Mr. Douglas Campbell, of Pittsburg; Mr. C. L. Pullen, of Philadelphia; Mr. Pemberton Smith, engineer, of Buffalo.

Digitized by Google

THE DIAMOND STREET IRON CO., Wilmington, Del., exhibited the Churchill rail joint for T and girder rails.

JAMES HITCHCOCK exhibited a reversible car seat, which is operated without turning the back. The seats are upholstered in rattan and plush and are manufactured at North East, Pa.

JOHN C. CURTIS, Chicago, exhibited the Lawton peerless fender. This is a scoop spring fender, which is raised and lowered by means of a wire cord and shaft operated by a crank handle.

PENNSYLVANIA CAR WHEEL CO., Pittsburg, exhibited a full line of motor and trail car wheels. This company manufacture wheels for any kind of service in any diameter from 12 to 42 inches.

D. C. SWEET, Springfield, Mass., exhibited car wheel grinding machines full size. This machine is so designed that the wheels may be ground over a pit in any part of the car house, being operated by the car motor itself. Mr. Sweet was himself in charge of the exhibit.

THE TAYLOR ELECTRIC TRUCK CO., Troy, N. Y., exhibited several trucks, both single and double, one of the single trucks embodying all the latest improvements. The exhibit was in charge of Mr. John Taylor, manager; Mr. Robert Kasson, foreman, and Mr. Aubrey Tupper, of the office staff.

R. BLISS MANUFACTURING CO., Pawtucket, R. I.—The exhibit included the Woods patent platform gate mounted in position on the platform of a car. Over 4,000 of these gates are operating on the street car lines of Boston. The exhibit was in charge of N. H. Colwell, manager, and Charles O. Wood.

THE BALTIMORE CAR WHEEL CO., Baltimore, Md., exhibited both their single and side bearing double trucks of the Lord Baltimore type. The special feature of these trucks was a new adjustable axle collar. The exhibit was in charge of J. Paul Baker, secretary, and A. E. Baker, representative in London.

SPRINGFIELD MANUFACTURING CO., Bridgeport, Conn., exhibited emery and corundum wheels and over 250 varieties of grinding machines, dry grinders, roll grinders, surfacing machines, tool grinders, universal grinders, etc. The exhibit was in charge of G. W. Jackman, manager, and Mr. G. E. Martin, mechanical engineer.

THE JOHN STEPHENSON CO., car builders, New York, exhibited a model ¼ size of a Broadway cable car with double doors and gates, the safety brake, Providence fender, mounted on Peckham truck and equipped with Sterling registers and headlights and lamps. The exhibit was in charge of Mr. Henry Woods, who designed and made the model.

ROBINSON ELECTRIC TRUCK AND SUPPLY CO. The exhibit included models of both types of trucks, the well-known electric truck and the new six-wheel radial truck for passenger and palace car service. The exhibit also included the Robinson interlocking truss rail joint. In connection with the exhibit was printed matter describing a new departure in electric railway construction, designed as a suggestion for converting steam railways to be operated by electric power. Mr. Wm. Robinson, general manager of the company, was in charge.

CHRISTENSEN ENGINEERING CO., Milwaukee. This exhibit included a No. D 4 air compressor in operation, this being the type of compressor used on the Metropolitan West Side Elevated, of Chicago, and the B. & O. Belt Line, of Baltimore. There was also a No. B 2 air compressor in operation, the current to the motor being controlled by an automatic cut-out. The third exhibit consisted of a No. AA 1 air compressor designed for double-truck high-speed heavy cars. Mr. N. A. Christensen, Mr. S. W. Watkins, Mr. Frank C. Randall and Mr. W. J. Davidson were in charge.

THE PENNSYLVANIA STEEL CO., Steelton, Pa., exhibited samples of their "Adamantine" cast steel special work and track fixtures, the most interesting feature being a 10 inch switch, mate and frog manufactured for the Boston Elevated Railway Co., the Pennsylvania Steel Co.'s Adamantine work being the standard on this road, as well as most of the other large roads of the country. They were represented by Messrs. Charles S. Clark and Wm. E. Cuntz, Boston agents; Mr. Stephen A. Baldwin, New York agent; Mr. C. W. Reinochl, and Mr. Mason D. Pratt, chief engineer.

NEW YORK SWITCH AND CROSSING CO., Hoboken, N. J. This exhibit included a specimen of their special work for crossings and switches, the particular features of which are that the centres are of chrome steel cast in position. The most interesting feature of the exhibit, however, was their electric switch in operation, so arranged that the entire mechanism could be inspected. This switch is designed to be operated by the current, which is under control of the motorman. Exhibit was in charge of Mr. W. C. Wood, president; Mr. L. E. Robert, secretary, and Mr. A. J. Baldwin, electrician

TAUNTON LOCOMOTIVE MANUFACTURING CO., Taunton, Mass., manufacturers of snow plows for street railways, sprinklers, transfer tables and brake handles. The exhibit included three snow plows. First the double type share plow for use in city work, weighing 8½ tons. The second, or heavy nose car, weighs 10½ tons, and is claimed to be the heaviest appliance of its kind ever put on the market. It is designed for the heaviest kind of drift work, and is recommended only for extreme service. The third plow is the standard nose plow, which weighs 8½ tons, and is claimed to be heavier than any nose plow now on the market. The last two plows are for single track work. The wing mechanism on the standard nose plow is like that on the double track share. The digger mechanism has been designed with special care to stand the terrible punishment which diggers must receive, and steel coil springs give the necessary yielding feature if the diggers strike the end of a switch or a guard rail. The company also exhibited the Collins noiseless ratchet brake handle. Mr. Wm. R. Billings, treasurer, with the selling agents, Messrs. Wendell and McDuffee, were in charge of the exhibition.

SOCIETY & CLUB NOTES

Independent Telephone Association Meeting.

It having been announced in one of our contemporaries that the next meeting of the Association will be held in June, 1899, we are requested to publish a denial of this report, as it was unauthorized. Preparations are now being made for a big meeting in October, although it is not fully determined.

The Street Railway Accountants' Association Meeting.

The Street Railway Accountants' Association of America held their second annual meeting in Boston at the same time as the American Street Railway Association, occupying a hall adjoining that of the former. The following papers were read: "Car Mileage—How Arrived At and Its Use," by A. H. Ford; "Statistics, Their Use and Abuse," by E. D. Hibbs.

The standing committee on "A Standard System of Street Railway Accounting, Covering the Classification of Operating Expenses, Classification of Construction and Equipment Accounts and Form of Annual Report," handed in its report, which was discussed at length.

A feature of the accountants' meeting was the exhibition of blanks and forms employed by a large number of street railway companies, which were spread out on tables in an adjoining room.

The Maritime Electrical Association.

The first convention of the "Maritime Electrical Association" will be held at Halifax, N. S., on September 27. A number of papers have been prepared, a good programme arranged and a large number of members are expected to attend. This association, which has only been in existence about six months, has a large membership list, and gives promise of doing a good work.

Association of the Edison Illuminating Companies.

In connection with their fourteenth annual convention, held at Sault Ste. Marie, Michigan, on September 12, 13 and 14, the above association have issued a very handsome booklet illustrating scenery around this beautiful and important manufacturing centre, as well as giving the members useful and valuable information regarding the place and its surroundings. On the cover is a half-tone illustration of the steamer Northwest entering a lock; then follows a history of the Edison Sault Ste. Marie Electric Company, a sketch of Sault Ste. Marie, Michigan's oldest

Digitized by Google

settlement, some interesting facts of the historic Fort Brady and details about the present city of Sault Ste. Marie, with its 10,000 people and world-wide fame. Then comes a description of the celebrated locks and details about the water power in that neighborhood, 20,000 h. p. of which is now being developed to be devoted to the manufacture of calcium carbide. Other power companies are now developing 100,000 additional horse power. The booklet is profusely illustrated and neatly bound with a white silk ribbon. It is a great credit to this enterprising association, whose annual meeting, judging from the preparations and the papers to be read, will be a most entertaining, instructive and valuable one. The paper by Messrs. J. W. Lieb, Jr., J. Van Vleck and Arthur Williams on what they saw abroad on their recent tour will certainly be awaited with a great deal of interest and anticipation.

Free Guide Book.

A very handy and comprehensive guide to Boston has just been published by the Mechanics Fair Committee and is being eagerly sought by intending visitors to the exhibition, as well as by others who contemplate a trip to Boston. The book is up-to-date, with readable descriptions of the city's most notable points and objects of interest, and will be found very handy for reference.

The big building of the Massachusetts Charitable Mechanics' Association on Huntington avenue is rapidly being prepared for the exhibition which will open October 10 and which will undoubtedly prove the most important and interesting ever given by this organization.

The Committee has decided that anyone sending a two-cent stamp to Henry D. Dupee, secretary, Mechanics Building, Boston, will receive by return mail a copy of this valuable little guide-book free of charge.

Spiral Versus Coil Springs.

I WRITE to protest against the continued and erroneous use of the word "spiral" in describing coil springs. A spiral is a plane figure, and a spiral spring must and can only be a flat spring such as a watch or clock spring. Coil springs are true helices, and should so be denominated. In perusal of the description of the Mechanicville Transmission Plant, which appeared in your issue of September 1, the word "spiral" occurs in describing the springs of the plunger switches. The construction, however, would indicate that a coil or helical spring was used in this device. I know, of course, that the term "spiral" is largely used in connection with helical figures. We have "spiral" springs, "spiral" packing, and so on, but this usage by no means makes the term a correct one in these instances, and when a description of a spiral or clock spring is intended, the reader is puzzled and in doubt unless the construction of the device in which it is used is obvious.

This misuse of the word I have often seen in the class of technical journals that are filled chiefly by letters from Heaven-born engineers, who leave the subject under discussion to descend to personalities, and there it is to be expected, but such careless nomenclature is utterly at variance with the standard of The Electrical Engineer, and I must confess that I was somewhat surprised at seeing the term misapplied in the article mentioned. It is high time that this misuse be corrected, primarily because it is wrong, and secondarily because it causes ambiguity and leaves the idea to be conveyed indeterminate.

New York, Sept. 3, 1898. LAMAR LYNDON.

Some Modern Brush Holders.

In an article entitled "Some Modern Brush Holders," which appeared in "The Electrical World" in the issue of July 23, it is inaccurately stated that the C & C Electrical Company use the so-called "reaction brush holders" as licensees under a patent issued by Mr. R. N. Baylis. The principle involved in the reaction brush holder was discovered and patented by Mr. Baylis, who, however, was at the time chief engineer of the C & C Electric Company, and was materially assisted by that company in making the experiments necessary to the developing and perfecting of the brush holder. The C. & C. Electric Company were the first to use this form of brush holder, and have used it for the last five years, not by license but by proprietary right. May I ask you to publish this letter, with a view to correcting any apprehension on the part of those interested in this subject?

Very truly yours, D. W. BARNES,
General Manager C. & C. Electric Company.

New York, Sept. 2, 1898.

Moribund Manhattan.

Your editorial on the "Moribund Manhattan" is one of the most interesting and timely articles which has been published upon this subject. Since coming to New York three years ago I have made a study of the Manhattan Elevated Railroad, and have no hesitation in concurring with Col. Prout, when he says in effect, that the Manhattan Elevated Road is thoroughly well managed, and giving to the people of New York a safe and efficient service. This is certainly a fact, taking the road in its present condition, and considering it as being exclusively a steam railroad. But a steam railroad is not what the people of New York require at the present day, and must certainly be looked upon as somewhat antiquated. After studying the matter closely, I cannot but feel that if the elevated roads were to adopt electric traction, and provide electric elevators at every station, together with comfortable open cars in summer, there would be very few people who would care to patronize the surface cars except for short distances.

CHARLES CAMPBELL, JR.

New York, August 24, 1898.

Electrical Engineering Course at Drexel Institute.

THE purpose of this course is given on page 4 of the circular just issued by the Institute. No effort is made to graduate electrical physicists. On the other hand, there is a constant endeavor to acquaint the students with the materials, devices and methods of constructive as well as experimental engineering. The course lasts only through two years, since the Mechanic Arts Course of the Institute, which precedes it, includes the science work, mathematics, mechanical drawing and shop work, which occupy a considerable part of the electrical engineering courses in so many colleges. The laboratories are thoroughly well equipped, as indicated in the circulars, including the latest types of apparatus, as well as those of recognized and standard worth. In the evening classes the same laboratory facilities are used as in the day work, and the instruction is by the same teachers. There are two courses, as the circular indicates: The one winter's course is of necessity a simple one, but it deals almost wholly with the machinery and appliances that the dynamo tender, supply dealer and wireman wants to know about. The two years' course approaches as nearly as possible in the time at disposal the grade and scope of the work given in the electrical work of the regular electrical engineering course. Many mechanical and civil engineers find this course useful, and young men who are high school graduates or manual training school graduates find in this work an opportunity to supplement the training in electricity they have already received.

These evening classes run from October 1 to April 1. Each course has two evenings per week. The fees are entirely nominal. The courses have been brought to a high state of perfection by Prof. Arthur J. Rowland.

THE TRIUMPH ELECTRIC CO., of Cincinnati, inform us that in the suit for infringement brought against them by the Westinghouse Electric and Manufacturing Company, Judge Clark, of the United States Circuit Court for the Southern District of Ohio, has given a decision in their favor, and declared the patent on which the Westinghouse Company based its claim as void.

Digitized by Google

NEWS & NOTES

20th Annual Clambake of the American Electrical Works, of Phillipsdale, R. I.

THAT the annual clambake tendered to the electric fraternity by the prince of hosts, Mr. Eugene F. Phillips, of the American Electrical Works, is yearly becoming more popular was evidenced by the large attendance on the occasion of the twentieth bake last Saturday, September 10. All told there were some 310 guests at the Pomham Club on that day, a larger number than on any previous occasion. It was a record-breaker in more ways than one—largest number of guests, magnificent weather (Mr. Phillips, it is well understood, has a special "pull" with the Weather Bureau), a splendidly appointed dinner and souvenirs of unusual beauty and usefulness.

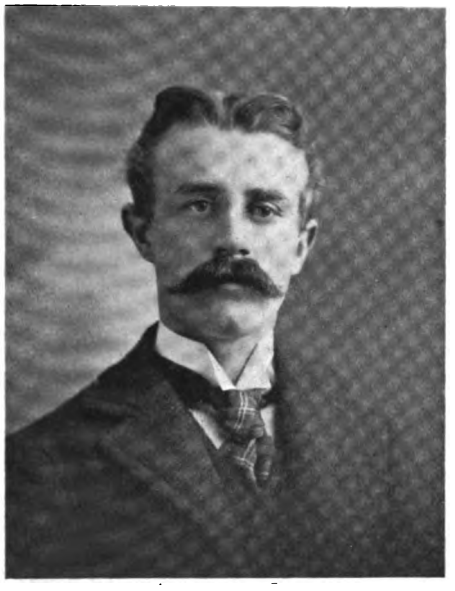
Mr. Phillips' guests began to gather about the Narragansett Hotel about 10 o'clock, where special cars speedily conveyed them to the Pomham Club, where all the usual good cheer and fund of amusements awaited them. On registering each guest was presented with a decoration for the lapel of the coat bearing the name of the American Electrical Works in neat design, but having a new feature this year in that each decoration bore a different number in large type, so that each guest was distinctively numbered, we presume to provide for possible identification later by the authorities of the City of Providence in case of temporary aberration. (Latest telegraphic advices advise us that so far no numbers have been reported and that the city has returned to its normal quiet.) A white cap, somewhat of a source of terror at first to a few of the married men, was also presented to each guest, which, when donned by the three hundred guests present, gave a very distinctive appearance to the gathering.

An excellent lunch was served about noon, while many indulged in all sorts of outdoor sports—baseball, shooting at the target, quoits, bowling, etc., all of which, while serving to provide amusement, also served to produce a prodigious appetite for the more serious exercise of disposing of the elaborate dinner which was served punctually at 2 o'clock. During the eating of the clams and fresh corn a beautiful souvenir of the occasion was distributed to each guest in the shape of a handsome pipe and package of tobacco, a souvenir which appeared to meet with the strongest approval of all present and which, no doubt, will be carefully preserved for many years. Many of the guests began to put this useful souvenir to immediate use, and the "pipe of peace" was soon in evidence, while the fragrant clouds of smoke made it clear that Mr. Phillips' selection of a souvenir this year was particularly apropos.

At the conclusion of the dinner Mr. Phillips addressed the audience in his well-known happy way, giving his guests a hearty welcome, in the midst of which he made a very happy allusion to his two sons who are now officials of the company and who, he guaranteed, would continue to extend the hospitality of the company on similar occasions indefinitely, even should he retire as the active host, which the writer hopes will not be for a great many years. Mr. Phillips also made graceful reference to his agents in the various cities, whom he termed as the "working horses," and who were all present to witness their own popularity on their names being mentioned.

Mr. Brown, of the Westinghouse Company, acted as toastmaster and filled this honorable position to the complete satisfaction of all present, having an inexhaustible fund of humor and anecdote, which he used with the happiest results.

Mr. Ira A. Winsor, the city's acting Mayor, replied to the toast of the "City of Providence," and Mr. C. M. Van Slack also made some happy remarks. Mr. T. C. Pennington, secretary of the American Street Railway Association, replied to the toast of the "Electric Railways," and Mr. Maurice Coster, of the Westinghouse Company, Chicago, made a few remarks on the electric lighting industries, particularly in the West. The toast of "The Electrical Press" was ably responded to by Mr. C. H. Goddard, of "The Electrical Review," who also made some feeling remarks about the absent sex, after which short addresses by Captain Wm. Brophy, of Boston; General C. H. Barney, of New York, and Master Mechanic Baker, of Boston, completed the exercises. A short hour more was spent on the piazzas of the club overlooking the Providence River, when a return was made to the city and one of the most enjoyable of Mr. Phillips' many happy entertainments was an event of the past, not, however, to be readily forgotten.



E. Rowland Phillips,
Vice-President and Superintendent.

Eugene F. Phillips,
Founder and Manager.

Frank N. Phillips,
President.

THE PHILLIPS TRIO OF THE AMERICAN ELECTRICAL WORKS.

Two New Forms of Apparatus for Measuring the Acceleration of Gravity.[1]

BY PROF. R. S. WOODWARD.

IN this paper the author described and indicated the mechanical theories of two new forms of vibrating apparatus which will afford precise measurements of gravity. The first form may be called a flexible pendulum, and consists of a heavy bob suspended by a long piece of steel tape fastened rigidly at the point

[1]Read before the A. A. A. S. Abstract.

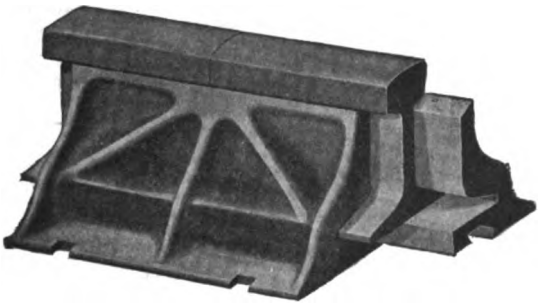
Digitized by Google

of suspension. It is proposed to suspend this pendulum in a tube from which the air may be exhausted, so that vibration may take place in vacuo practically.

The other form of apparatus consists of a helical spring suspended from one end and carrying a heavy mass at the other. A mass supported by such a spring will vibrate, like a pendulum, isochronously, and observation of the time of vibration along with the measurement of the static elongation of the spring will give data from which the acceleration of gravity may be computed.

American Rail Joint Mfg. Co., Cleveland, Ohio.

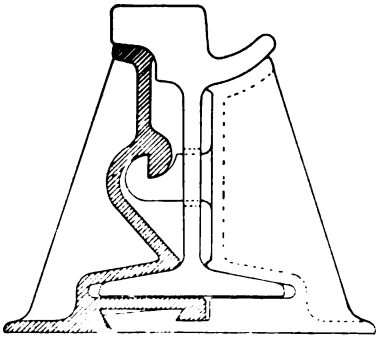
THE type of rail joint manufactured by this company is known as the "Standard" rail joint and was designed in 1891 and put in service at Toledo, Ohio, and during the year following quite a large number were installed on Western roads, so that they have now had six years of service, and there are numerous testimonials as to the value of this type of joint for



AMERICAN RAIL JOINT COMPLETE.

both street railway and steam purposes. These joints are in all cases made of malleable iron and in two parts, and are united by what is known as the "Wedge" principle. For joints employed with T-rails the interlocking channels are in the base, and there are two tapering surfaces in each piece, the taper being ⅜ of an inch to a foot. In attaching the joint to the rail no bolts whatever are used. The primary half of the joint is provided with lugs which fit into the bolt holes in the rail, the lugs being a little smaller than the holes to provide for expansion.

In attaching the joint, the primary half is first put in place, then the secondary is placed against the rail to the right or left of the other so that the channels register when it is driven into place by a heavy hammer. The shoulders of the joint are ground to fit the rail, and when in place both halves fit the rail snugly under the head and at the base, but do not clamp the web of the rail, and when in place the base of the joint is twice as wide as the base of the rail, and the joint may be located on a tie or suspended between ties. In the case of high girder rails the joints are made to lock at two points, the lugs of the



AMERICAN RAIL JOINT SECTION.

primary being made to extend through the web of the rail with a shoulder cut in the top into which a ridge on the secondary plate is made to lock. Both halves of the joint are strengthened by webs as shown in the illustration, and one end of the secondary half is provided with extra metal to receive the hammer blows.

These joints are made in two sizes, 7 to 10 inches in length, and weigh from 25 to 35 pounds for T-rails and from 35 to 45 where designed for girder rails. As will be seen from the structure, the joint is one of unusual strength, and in the test recently made at the McGill University of Montreal a joint for a 75-lb. T-rail when in place was deflected to a permanent set of .044 inches only under a weight of 150,000 pounds, and this was a 10-inch joint which weighed 31 pounds. Besides joints, the company make an intermediate chair or brace joint that takes the place of a chair that is made in the same form as the joint, but is only half the length. This has many advantages over an ordinary chair, as it clamps the rail securely and does not depend upon the spikes to hold it in position. The company design joints to fit any type of rail when the name of the maker with the section number of rail is submitted.

The company were originally organized in 1894, but were reorganized on April 1 last. The present officers are S. H. Chisholm, president of the H. P. Nail Co. of Cleveland, president; Dudley Baldwin, vice-president and treasurer; Thomas L. Johnson, secretary; while the business affairs of the company are under the direction of W. E. Ludlow with the title of general manager.

PERSONAL

MR. MORGAN BROOKS, president of the Electrical Engineering Company, of Minneapolis, has been appointed to the chair of electricity in the University of Nebraska, rendered vacant by the going of Prof. R. B. Owens to McGill University. Mr. Brooks, who has for some time past lectured on electricity at the University of Minnesota, is a graduate of Brown and of Stevens and has had a large experience on the practical side of engineering. His business interests will be retained.

MR. WM. HAND BROWNE, JR., has recently been appointed assistant professor of electrical engineering at the University of Illinois, Champaign, Ill. Mr. Brown was until recently instructor in this branch at the University of Nebraska, associated with Prof. Owens. His college training was obtained at the Johns Hopkins University, where he took his first degree in 1890 and his second in 1892. His practical work includes a full experience with lighting, railway and isolated plants, having practiced as a consulting engineer for some years in Baltimore and vicinity.

THE STOCK MARKET

Lower Prices and Higher Money.

During the past week the condition of things in the stock market resolved itself into a lower range of prices for securities, due to a lowering of the bank reserves and higher rates for money. One other feature depressing stock was the declaration of a lower rate of dividend on St. Paul than was expected, as the road had well earned it. This, however, as a proof of conservative management, should mark stocks up, and in the long run must do so. Railroad earnings continue good, trade is brisk and the crops are reported at the best average for ten years.

Western Union during the week declined to 93 on sales of 10,046 shares. General Electric, which was as high as 46⅞, fell off to 43¾ on sales of 19,685 shares. In Boston, American Bell Telephone stood around 280, closing at 281.

Copper is now quoted at 12.25 cents. Heavy steel rail is $18.

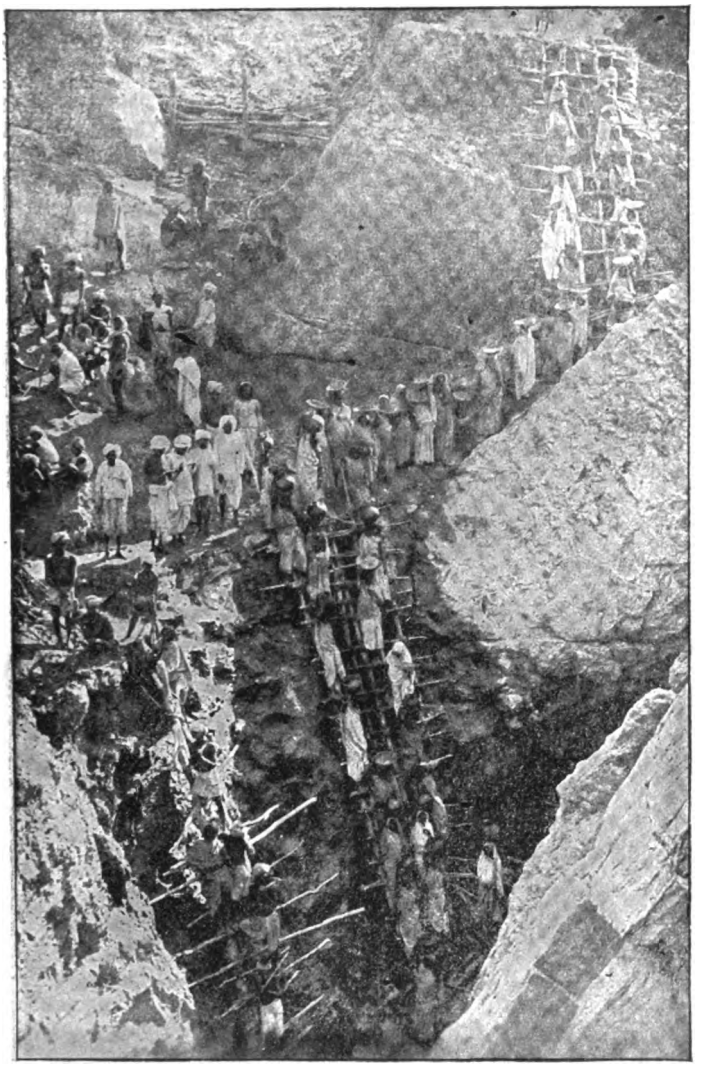
IN A LETTER to the Westinghouse Electric and Manufacturing Company, Mr. Horace E. Andrews, president of the Cleveland Electric Railway Company, Cleveland, O., states: "We are delighted with the operation of the No. 49 motors, and are having better success with them than with any other motors we have ever operated." This motor embodies all of the best features of previous types of Westinghouse motors, which have an established reputation as being the standard of excellence throughout the world.

Digitized by Google

TRADE NOTES AND NOVELTIES

India Mica and Micanite.

FROM the mines of India the world has been supplied for centuries with mica, it being the only transparent sheet known to the arts before the production of glass plate. Probably the most extensive use of mica in India is for ornamental purposes, either in its natural state or artificially colored. In the days of ancient Rome the powdered material was scattered over the surface of the amphitheatre to obtain a brilliant glistening effect. In India it is used at native festivals, marriages and in the Mohammedan Maharan for processional ornaments, as lamps and tinsel decorations, on banners, on fans, in temples, palaces, etc. The lanterns used by Columbus on his first voyage were protected by mica, probably from these mines.



FIGS. 1 AND 2.—OBTAINING AND PACKING MICA IN INDIA.

The mica mines of India are near the interior and very inaccessible. The only American mica miner who ever visited these mines was Mr. Franklin Brooks, of Eugene Munsell & Co., and what he saw there was an interesting revelation of antiquity, both from an engineer's and a miner's point of view.

The mine which is known as the "Abruker Mine" produces the finest mica that has ever been mined, both for lamination and color. The mine in question has been sunk about 200 feet, following the pitch of the vein, and all this mica and refuse has been raised and carried away by the natives. No machinery of any kind, except drill and hammers, is used in their mining operations. The refuse and the mica are placed in baskets, which hold about ten pounds, and are passed up from hand to hand by the women who stand in line on the ladders. When the top is reached the baskets are dumped and returned down the ladder in the same manner, but by another line of women. Water is taken out by jugs. Fig. 1 shows the women at work, and also another ladder which is provided for the miners to enter the mines.

There is no reason to believe that there has been any change in this method of operation for many hundred years, except that there is more care taken to protect the miners.

After the crude mica is taken from the mines it is first roughly trimmed and then sorted into different grades, according to sizes and quality. It is then taken to the mica workers, who split it up and scribe out the size for it to be cut into by the shearers. Then the cut pieces are cleaned, weighed and packed ready for shipment.

Fig. 2 shows the mica workers cutting and packing. The mica is sent to the general storehouse in baskets, on the backs of bullocks and in bullock carts. The prepared mica is loaded in carts, drawn by bullocks, and carried in this way hundreds of miles to shipping points at the speed of about ten miles a day.

Mica, or muscovite, its geological name, in nature is formed in pockets, where it is crystallized in large sheets. Sheets under 2" x 2" are of little commercial value.

The occurrences of these pockets cannot be predicted by the geological formation; this makes it one of the most hazardous forms of mining, and for this reason a great number of mines have actually cost more to mine than the mica produced could be sold for.

Mica is an anhydrous silicate of calcium and aluminum, and crystallizes in a laminated mass easily split along its axis, and can be subdivided down to $\frac{1}{10000}$ of an inch of thickness. Being both fireproof and transparent, it is useful for many other purposes in the arts, besides that of an insulator. Two requirements of an insulator of universal adaptability should be elasticity and flexibility, and these qualities are not found in any of the natural mica formations, nor does it permit of being readily worked with tools in its natural state. But mica is fireproof and its insulating qualities are unaffected by time. By splitting up the mica into laminæ and reassembling these thin sheets and solidifying them by use of a highly insulating cement, by the application of high pressures and temperatures, the manufactured "micanite" is made perfectly homogeneous.

The improvements effected by this relamination are: To increase the insulating properties over any sheet of natural mica, which varies greatly for different parts of one sheet, but by

Digitized by Google

splitting up the mica and reassembling the insulating qualities of the mica are greatly improved by averaging up.

Micanite in its manufacture has introduced into it a material in the form of cement, which absolutely excludes all moisture and is impervious to water.

Reliable tests have shown that micanite possesses a high degree of insulation, which, combined with its mechanical rigidity and non-absorbent and fireproof qualities at normal temperatures and the facility by which it can be formed at high temperatures, its property to maintain its insulation under exposure, have made micanite as perfect an insulator as can be desired.

For the above information we are indebted to the firm of Eugene Munsell & Co., of New York and Chicago, the well-known dealers in mica, micanite plates, cloth and paper for commutators and other insulating purposes. They also deal in the well-known M. I. C. insulating compound and "Empire" oiled paper and cloth. They have issued a valuable book giving information about mica and micanite, as well as interesting information on armatures and commutators.

Ohio Brass Company's Railway Appliances.

IT is an unquestionable fact that the success and efficiency of operation of any street railway is dependent to as great an extent upon the appliances used in its line construction as it is upon its rolling stock, its employes and business management. This being so, it is not at all surprising that the Inter-urban Cleveland lines described in our last and this present issue have been attended with such marked success, when we learn that their line material has been furnished by so reliable a company as the Ohio Brass Company, of Mansfield, O. They are manufacturers of electric railway supplies of every variety, a few of which we illustrate herewith. Most of these have been installed on the lines of the Cleveland, Painesville and Eastern, the Loraine and Cleveland and the Cleveland and Chagrin Falls, on which the series of articles by Mr. C. B. Fairchild have been appearing in our pages.

Fig. 1 represents the new type "D" standard street line hanger, which they furnish japanned and galvanized. The latter article is being used by all of the three roads mentioned above for straight line suspensions. Fig. 2 is the standard D. W. trolley clamp for supporting Fig. 8 trolley wire. This trolley clamp is used in connection with the street line hanger shown in Fig. 1 and in connection with an insulated bolt manufactured by the company. Fig. 3 shows style A Wood's flexible bracket in use by the Cleveland and Chagrin Falls line. Fig. 4 represents a single curve pull-over body for supporting the double Fig. 8 trolley wire. This is used by the three companies. Fig. 5 shows the standard trolley wire for connecting Fig. 8 wire, and is also used by all three companies, who are using Fig. 8—000 trolley wire supplied by this company. Besides the specialties shown, the Ohio Brass Company manufacture such railway appliances as hanger wrenches, straight line and pipe bracket hangers, single and double curved hangers, trolley wire ears, strain insulators, steel and copper bonding caps, railway motor bearings, etc. A complete catalogue is issued by the company, illustrating their numerous goods, and will be sent to any one on application.

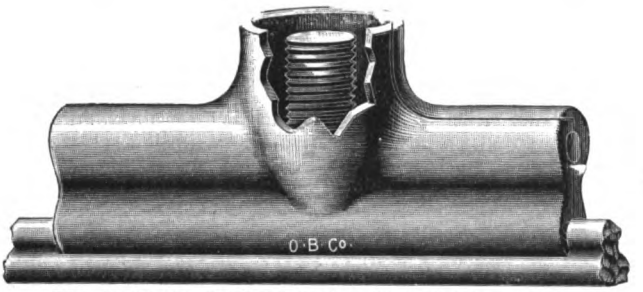


FIG. 2.—D. W. TROLLEY CLAMP, OHIO BRASS CO.

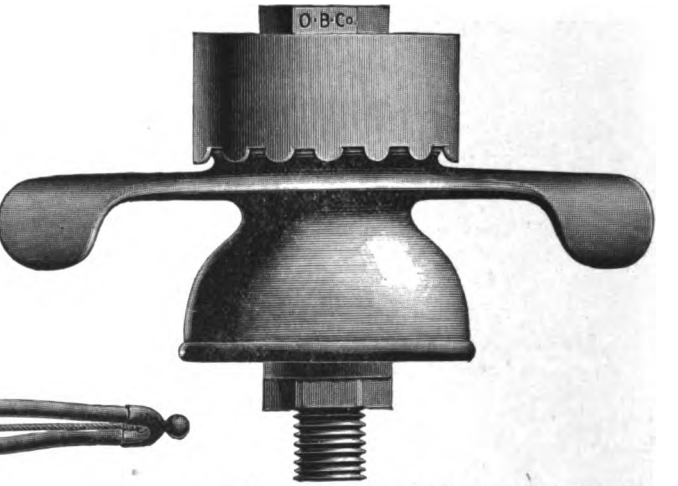


FIG. 1.—TYPE D, STANDARD ST. LINE HANGER, OHIO BRASS COMPANY.

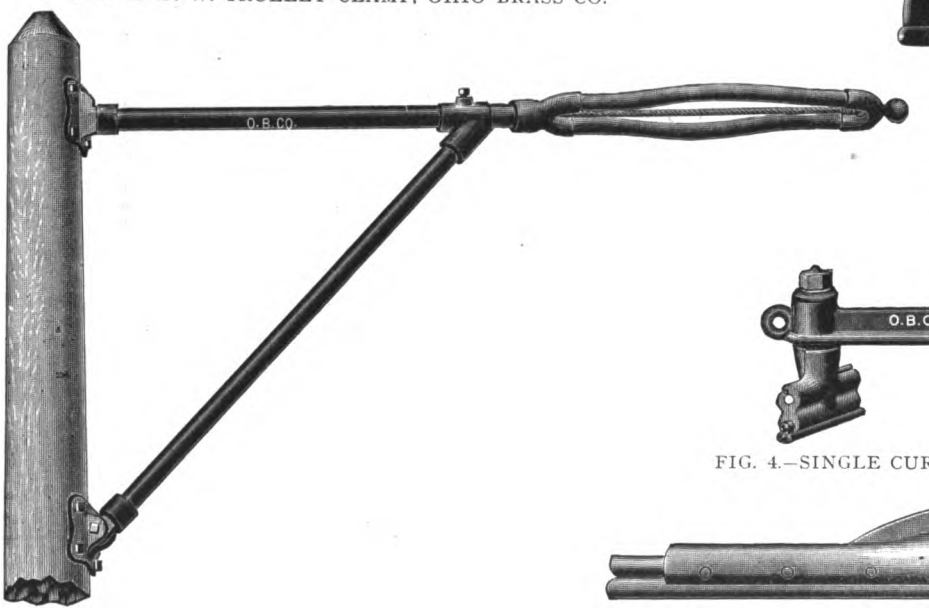


FIG. 3.—WOOD'S FLEXIBLE BRACKET, OHIO BRASS CO.

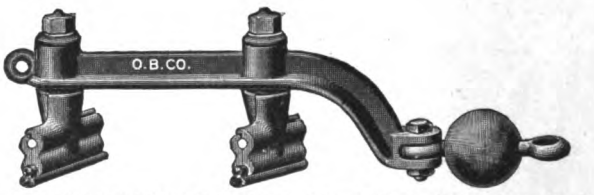


FIG. 4.—SINGLE CURVE PULL-OVER BODY, OHIO BRASS CO.

FIG. 5.—FEEDER WIRE SPLICER, OHIO BRASS CO.

G. C. Kuhlman Car Company, Cleveland, Ohio.

THIS company have the reputation for building an exceptionally strong and durable car, and of late years have made a specialty of long car bodies designed for high speed electric service, many of which are running near Cleveland and are described in the articles on some of the Cleveland interurban roads in the last and the present issues. Mr. G. C. Kuhlman, the principal of the firm, learned cabinet making from his father, who is still extensively engaged in the manufacture of furniture and interior house finishing. The company were first introduced to the street railway fraternity, through the Mahling car, a specially designed car which was introduced to a considerable extent some years since in Cleveland and Detroit and which this company manufactured, many of which are still running, but are not being extensively manufactured. This was a specially designed car with side aisles, side doors and side steps. The car business was established in 1893 and the shops were located on St. Clair and Perry streets, where they remained until they were destroyed by fire in 1895, after which the com-

Digitized by Google

pany moved to their present quarters on Broadway, where the works occupy two brick buildings which were formerly designed as car houses for one of the local street railways. The main building is 66 x 410 feet and is occupied by the machine shop and erecting department, while the paint shop and trimming department occupy a second building which is 48 x 230 feet, and located on the street end of this building are the offices of the company. Extensive yards for the storage of lumber and material adjoin the buildings.

The engine room is located at the rear of the main building, and the power is supplied by a 180 h. p. Bates-Corliss engine. From this the two main shafts, which are located under the floor of the machine shop, are driven, and each machine in the wood-working department is driven by a belt coming up through the floor. Adjoining the engine room is the drying kiln in which the lumber is seasoned. This is 25 feet square and hot air is forced through the chamber by means of a Sturtevant fan, the air being led over coils of steam pipe. The same method is followed for heating the buildings and the air is led through a very extensive system of galvanized pipes supported by the roof members, with branches which direct the air to different parts of the shops. The wood-working department is equipped with a number of first-class tools of modern design on which all kinds of planing, mortising and gaining is done, and there is being added a hollow chisel mortising machine manufactured by the Greenlee Brothers Company. The erecting shop occupies the front end of the main building, which is well lighted and provided with tracks and pits and specially designed trucks by means of which car bodies are shifted about. Recently there has been added in this department a wide platform or gallery on two sides of the room which is supported by iron rods from the roof members. On this the cabinet work is done, and a portion of it also answers for storing finished material. On one side of the erecting shop the blacksmith forges are located, and here are lathes, drills, punches and shears for preparing the iron sill plates and other metal parts which now enter largely into the construction of high speed cars. From the erecting department the bodies are shifted to the paint shop, where they are painted, lettered and finished. A room is divided off from the main floor of this department in which the sashes are varnished and glazed.

Among the orders in hand are noted twenty cars for The Cleveland Electric Railway and thirty for The Cleveland City Railway, with eight for the Akron Illuminating & Railway Company. Among the bodies designed for eight-wheel service are four for The Detroit & Pontiac Railway Company, eight for The Cincinnati & Hamilton Railway, and two for the Tiffin & Fostoria Railway Company. Besides new work the shops are engaged in repairing and rebuilding twelve eight-wheel cars for some of the neighboring high-speed railways running into Cleveland.

Ruprecht Electric Company, Cleveland, Ohio.

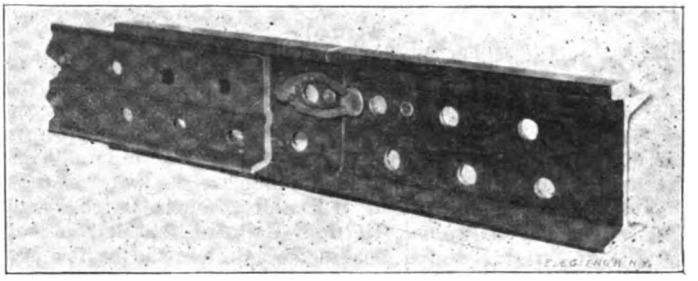
THE business of this company includes the manufacture of X-ray machines, storage batteries of the Plantè type, motors and dynamos, all of which have been designed by Mr. C. E. Ruprecht. The X-ray machines are mounted in two styles of cases, known as the upright and horizontal, the former made in two sizes, the case of one being 8½x16, the other 10x18 inches, while that for the horizontal type is 22x12x4½. In the construction of the X-ray machine the core of the primary coil is made of the best annealed Norway iron wire, each wire being insulated by a coat of varnish, which tends to prevent heat, and the primary winding consists of few turns, allowing of a low condensing capacity. The secondary winding is made in a number of sections, each highly insulated and assembled on primary tube, but in such a way that the primary and tube can be removed without disturbing the secondary coil. The break employed with these machines will take any current up to 110 volts without increasing the temperature at contact points. The machines are made in sizes to produce sparks from 3 to 20 inches, and by the use of an adjustable condenser any make of tube, either German or native, can be used. Holders and fluoroscopes are furnished when desired, and a principal claim made for this apparatus is that the price is lower than that of any other standard machine and that it is much lighter in weight than any other type of X-ray machine.

The storage cells manufactured by this company are of the Plantè type and are made in sizes ranging from 6 to 500 ampere hours. No paste is used in the manufacture of the plates, and some of the claims made for this cell are that it is light in weight, compact, durable, with a high discharge rate and is comparatively low in price.

The Forest City Electric Company, Cleveland, Ohio.

THE energies of this establishment are directed to the manufacture of commutator bars, collector rings, rail bonds, and copper castings and forgings for electrical purposes. Of the commutator bars the company have already manufactured over 1,600 different patterns.

The commutator bars have two names, depending upon the process of manufacture, and are known as "Roll Drop" and "Drop Forged." The former are manufactured from pure Lake copper, which is cast by special process from a pattern to the approximate shape, when it is cold forged or pressed to accurate size by hydraulic machinery, which process produces a dense fibre rendering the bar chemically durable, and because of its toughness and because in operation the commutator



THE FOREST CITY RAIL BOND.

glazes over, the mechanical friction of the brush is reduced, which, of course, adds greatly to the life of the commutator.

The "Drop Forged" bars are made from pure Lake copper bars which are forged hot to an approximate size, then trimmed and again forged cold to finished size, making an accurate flat bar without the ordinary defects of high centres and rounded edges. The "Roll Drop" bars being more crystalline, are slightly harder than the "Drop Forged," and for this reason preferred by many users, but large quantities of the latter are manufactured. Both types of bars have stood the test of time and are in all cases more durable than bars made from an alloy with copper because bars made from alloy are apt to be fused or oxidized by the electric spark. Both types of bars, unless for very small commutators, can be made with copper strips for tangs cast welded into the bar, getting perfect electrical and mechanical connection, which saves the labor of milling a slot and then riveting the tang to the bar.

The type of rail bond manufactured by this company, shown in the figure, is known as the "Protected," and is so designed that it can be attached to the rail under the fish plate, or it may be attached to the base of the rail between the ties. In the

"PROTECTED" RAIL BOND.

former case it is protected from mechanical injury and from injury by electrolysis, and when beneath the base of the rail it is safe from injury from vehicle travel on unballasted lines. The bond being flexible, it is readily shortened or lengthened for adjustment and readily yields to vibration and to the contraction and expansion of the rail. The bond is constructed from flattened copper wire wound into a closed elliptical loop, the number of wraps depending upon the required capacity. The loop being formed, lugs are cast to each end, making a perfect cast welded joint, after which the lugs are drop forged to the required size and shape to fit the bond holes. The bonds are attached to the rail by means of an improved bond welder which is also manufactured by the company, which consists of

Digitized by Google

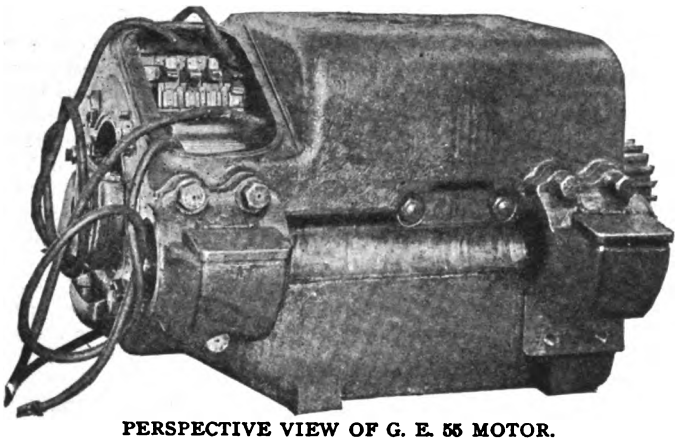
a cast yoke with a pair of screws which push the bond tightly into place, making a good contact without a riveted head. The bonds are made in different lengths from 2 up to 7 inches, or longer, if required, and in case of double bonding they may be made to span the end bolt holes as shown in the figure.

The works of the company occupy a three-story brick building at 17 Champlain street, while the copper foundry, which is one of the most thoroughly equipped in the country, occupies a separate brick building in the rear of the main building. The hydraulic presses, heavy drop hammers and furnaces occupy the ground floor. The punches and metal working tools and tools for pattern and die-making occupy the second floor of the building, on which the company's office is also located. Lighter machinery and storage and shipping department occupy the upper floor. The business was established 1894 and has enjoyed a very liberal patronage from the first, which is increasing rapidly from year to year. The products go to the users of electrical machinery in all parts of this country, and large foreign shipments are now constantly being made. The affairs of the company are under the direction of Mr. W. B. Cleveland, president and general manager.

General Electric Company's 160 H. P. (G.E.-55) Motor.

FOR elevated and underground railroads, as well as suburban and interurban railways, the General Electric Company have recently developed the G. E.-55 motor. The new motor, while differing but slightly in outward appearance from previous G. E. motors of similar capacity, embodies many important improvements, which, it is claimed, render it the only suitable motor for this class of work. It has already been tested on the New York, New Haven & Hartford Railroad, the Metropolitan and Lake Street Elevated Roads, Chicago, and on the locomotives of the Buffalo & Lockport Railway (described in our last issue), under actual steam road conditions, and has proved by its success the suitability of its design and the excellence of its construction.

The magnet frame is of soft steel cast in one piece in the form of a cube, with well rounded corners. In each end is a bored-out opening large enough to allow of the removal of the armature pole pieces and field coils. Into this opening fits a frame-



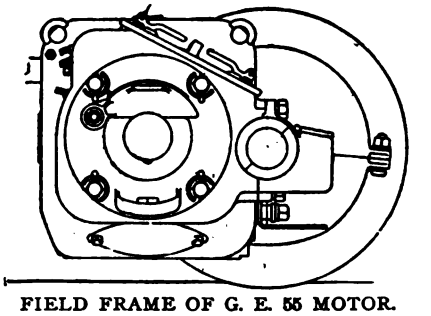
PERSPECTIVE VIEW OF G. E. 55 MOTOR.

head, held in place by four bolts, and carrying the armature shaft bearing. The axle bearing caps are bolted to vertically planed surfaces on the frame. The four-pole pieces are built up of soft iron laminæ and are bolted to the top, bottom and sides of the frame, with nuts on the outside. The frame has a large opening above the commutator, through which it and the brushes may be inspected and the worn-out brushes renewed. The brush holders and insulating supports may also be removed through this opening, which is protected by an easily removable iron cover, securely clamped down by an adjustable cam-locking device. In the bottom of the frame, directly under the commutator, is a large hand hole protected also by a cover.

The four field coils are wound on metal spools, held in place by laminated pole pieces. The winding is of strip copper of ample cross section, thoroughly insulated from the spool, and each winding is tested at the works to a potential of 5,000 volts.

The armature is of the iron-clad type, with a core built up of soft iron laminæ insulated from each other by coats of japan and assembled on a composition metal spider securely keyed to the shaft. The slots are so uniformly punched in the sheets that the assembled core has smooth and regular slots in which to place the conductors. The winding is of the series drum-barrel type and is made up of stranded copper conductors thoroughly formed and insulated before insertion in the slots of the core. The insulation placed on these coils is of the highest quality obtainable and is practically impervious to moisture. The conductors are soldered directly into the ears, which form part of the commutator segments, avoiding the use of connecting leads. Before assembling on the motor the armature is tested to withstand a potential of 3,500 volts between the commutator and the core. To prevent carbon dust from finding access to the end windings they are thoroughly covered with stout canvas bound in place.

The commutator segments of hard drawn copper are built up



FIELD FRAME OF G. E. 55 MOTOR.

and securely clamped on a malleable iron shell, the best quality of mica being used for the insulation.

The cone clamping insulations are of the same high-grade mica, built up and pressed hard into compact shape, but the mica between the segments is of a somewhat softer quality to allow of even wearing with the segments. Each commutator is subjected to a high potential test of 5,000 volts between segments and shell, and 500 volts between adjacent segments. Under all normal conditions it will run without injurious sparking.

The bearings of the armature are supported in the frame-heads, which extend inside the armature and commutator. They are lubricated by oil and waste, put in place through a hand hole, as with the ordinary car box bearing. The brasses take the form of a sleeve, with the sides cut away to expose the shaft to the oily waste. The use of oil makes it easier to keep the motor clean, and oil deflectors are provided to prevent any access of the lubricant to the inside of the machine. Drip cups cast into the frame heads under the armature bearings allow of the removal of used oil. The commutator end bearing is 3¼ inches in diameter and 7½ inches long, and the pinion end bearing 3¾ inches in diameter and 11 inches long. A similar system of lubrication is employed with the axle bearings, which measure 5¼ inches in diameter and 10½ inches long, as with the armature shaft bearings.

All the leads are brought out through rubber bushed holes in the magnet frame and are easily removable. The two brush holders are of cast brass, each carrying four carbon brushes, which slide in finished ways and are pressed against the commutator by independent fingers, giving a practically uniform pressure throughout the working range of the brushes. The holders are bolted to guides, which in turn are clamped to a specially designed mica insulated stud. The G. E.-55 motor is rated at 160 h. p. It weighs approximately 5,000 pounds.

Large Orders for the C & C Electric Company.

WE understand that the C & C Electric Company has been securing a large share of the U. S. Government's recent orders for electrical machinery. During the last six months they have installed a number of complete lighting and power plants for the Government, and it is stated that the 100 h. p. plant recently completed by them at Fort Delaware, Pa., is in every respect a model installation and was promptly accepted by the Government inspectors. During this same time, so we are advised, they have furnished the United States with some ten generators and over twenty motors. The company have also shipped last week to Vickers' Sons & Maxim, Manchester, England, six special 25 h. p. six-pole motors, designed, we are told, for direct connection to large gun lathes running at 200 r. p. m.

Digitized by Google

This is the celebrated firm of battleship and gun builders, one of the largest of its kind, and the fact that they selected C & C motors from among the many makes offered is an excellent tribute to the merits of the C & C apparatus. The firm of Waygoods & Co., also of Manchester, England, extensive manufacturers of elevators, are constantly ordering C & C motors and are loud in their praises of them.

A $1,000 First Mortgage Five Per Cent. "Plastic Rail Bond."

To meet the growing demand for reliable bonds, the Up-to-Date Street Railway Company of the Greater United States has seen fit to issue a number of first mortgage 5 per cent. bonds, due February 30, 1905, the interest on which is payable at the office of the Edison-Brown Plastic Rail Bond, 120 Liberty street, New York. At this latter office the important decision was reached that, in recognition of the good will of their patrons in the past, they would distribute these bonds gratis at the Boston convention of the American Street Railway Association. The happy possessors of these valuable bonds, which bear the significant signatures of P. Lastic Bond, president, and Resistance Low, secretary, per Manent, will, of course, treasure the beautiful souvenir and not fail to go to the office of the company each year and collect their $20. This is the six months' saving of running expenses due to the use of the plastic bond on 400 feet of track. We trust that the company will have numerous callers, who will repay the company for their present sacrifice by purchasing innumerable bonds in the future for themselves and their friends.

"New Standard" Dry Battery.

Mr. William Roche, the manufacturer of the "New Standard" open circuit batteries, reports very large orders which have recently been received from the United States Navy for his special "A" No. 1 cell, which in itself seems ample proof that the "Standard" dry batteries are high in quality and give entire satisfaction. Large orders for these cells have also been received from the Western Electric Company and the Standard Telephone and Electric Company, Madison, Wis., which may be looked upon as a good sign of the popularity of this cell. It is possible to crowd out a good article for a time, but these facts again show that a good thing is bound to get there eventually. The "New Standard" cells have come to stay, as is evidenced by the large orders Mr. Roche is constantly receiving.

New Machine Shops for Beaman & Smith.

Beaman & Smith, of Providence, R. I., are erecting a new machine shop 60 feet wide and 130 feet long, with an addition 20 feet by 50 feet. The construction will be modern in every respect. It will have a maximum amount of light consistent with good construction, will be practically fireproof and will be arranged with traveling cranes, trolleys and such appliances for easy handling of materials and machines. A portion of the building will be two stories high, arranged for suitable offices, draughting rooms, store rooms, etc. The entire framework of the building is steel built in brick work, entirely supported by the structural framework of the building. An electric traveling crane, having a capacity of 15 tons and a span of 40 feet, will run the whole length of the main building. The sashes in the sides of the building and in the sides of the monitors are arranged so that they can be readily opened for ventilation. The framework of the building is arranged with a view of easy attachment of shafting and counter-shafting for the transmission of power. The entire building was designed by and the steel work is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

CATALOGUES.

Russell & Officer Automatic Switch.

The Western Electric Company has recently issued Bulletin No. 7-RS, giving detailed description of the Russell & Officer automatic switch. The object of this switch is to allow the turning on or off of one or any number of lights from two or more points by means of push buttons. Its advantages are: That a large number of lights can be controlled by means of a push button switch without having to bring the main wire supplying these lights to the switch itself, a No. 16 B. & S. gauge wire answering the purpose for any size of switch; that a group of lights may be controlled from any number of points independently of each other, and that lights in large rooms or buildings may be controlled from a central point. The switch is also designed as an overload or underload switch when provided with a special relay. The magnets operating the switch depend upon the electric light circuit, and there are no batteries to get out of order or cause trouble. The switch is manufactured by the Western Electric Company, and further details can be obtained by writing for a copy of Bulletin 7-RS.

The Western Electric Company has recently issued a very neat forty-page pocket catalogue on lineman's construction tools. A large supply of tools is always carried in stock and orders can be filled promptly. If any of the readers of this paper have not received this catalogue a copy will be mailed upon request.

The long burning W. E. Petite Enclosed Arc Lamp manufactured by the Western Electric Company is now manufactured in three styles, plain and ornamental, with porcelain shades and plain with metal shades for factory and outdoor use.

The company also advertise that they are headquarters for electric heating and cooking apparatus.

The Niles Tool Works' Handsome Calendar.

Always wide awake to the needs of the times, the Niles Tool Works, of Hamilton, O., have sent to their friends in the trade a handsome calendar covering the month of September. It is well printed and presents very appropriately the chief occupation of the sportsmen during this month, namely that of fishing. It also shows a beautiful half-tone illustration of a large horizontal boring and drilling machine made by this company.

The William Powell Company.

This company, who are manufacturers of a large variety of lubricators, signal oilers and grease cups, located at 2525-2531 Spring Grove avenue, Cincinnati, O., have just issued a pocket edition of their No. 7 steam catalogue, which they are distributing among their engineering friends. It is of a convenient size to carry around in the pocket, and illustrates their line of brass goods. It also contains a large number of valuable tables compiled by the company, as well as useful information on matters that are liable to turn up and prove very puzzling. All this is arranged in a convenient form, which can be readily referred to and will certainly prove of value. This useful catalogue will be sent to any one on application.

Anchor Electric Specialties.

A very neat and interesting catalogue illustrating the various electrical products of the Anchor Electric Company, 71 Federal street, Boston, Mass., has just been issued and does much credit to this very enterprising company. A large number of the well-known Anchor switches are illustrated and their merits pointed out. Among the improvements introduced by this company should be mentioned the substitution for brass of steel nickel plated for any non-current carrying parts of the movement of the switches. Also a lining of cardboard extending one-hundredth of an inch below the edge of the cover of the snap-switch obviating all chances for short-circuit in removal of the cover. The binding posts are drilled eccentrically, which entirely overcomes the stripping of the binding screws. The moving contacts of the double-pole switch are entirely insulated from the working parts. The knife pattern contact has been adopted in all new designs. Their flush switches also embody many admirable features, such as heavy porcelain cups and flexible spring metals. Among the various types illustrated are the 500-volt switch, single and double pole, three and four-point switches, indicating and key switches, knife switches for switchboard work, Anchor sockets, attachment plugs, cut-outs, gongs, clocks, etc. The catalogue also contains diagrams as to the use of these switches and a complete index. The company have adopted a very clever method of designating the various metals and finishes used on their goods, denoting the former by letters and the latter by numbers, enabling customers to send telegraphic orders with-

Digitized by Google

out much expense or possibility of error. The catalogue will be sent to any one on application.

Builders' Iron Foundry.

This well-known corporation of Providence, R. I., have recently issued a complete catalogue of their products, containing 112 pages. It is called the "1898 Catalogue," and contains so large a number of products that the index occupies four closely printed pages. The business of this concern was established in 1822, and they have always been closely associated with the building and kindred trades, as their name suggests, and since 1861 have been constantly employed on contracts for the United States Government. The machine shops cover a floor space of 34,000 square feet, the foundry is about 30,000 square feet in area and the wood-working shops are about 6,000 square feet. The catalogue will be sent to any one on application to the company.

NEW YORK NOTES.

WILLIAM JESSOP & SONS, Ltd., Sheffield, England, and New York City, report having done more business for the past several months than for a number of years. As is known, Jessop's steel is claimed to be the finest made, and this with the increased demand for tools, drills, ties, etc., has caused this unusual sale of their goods. Messrs. Jessop & Sons have all kinds of steel in stock and solicit correspondence from those in the market for their goods.

THE O. K. DRY BATTERY, manufactured by the Nonpolarizing Dry Battery Co., 625 Broadway, is being ordered in large quantities by the United States Government. This battery is claimed to meet every requirement stated by its manufacturers, who will be pleased to send circulars, etc., to prospective buyers on application.

ADVERTISERS' HINTS.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., advertise motors for economical power service, including Tesla polyphase induction motors, direct current multipolar motors and direct current motors of the enclosed type.

THE BACON AIR LIFT COMPANY, 100 Broadway, New York, make a specialty of artesian well water supply, utilizing compressed air as the motive power for pumping.

A. L. BOGART CO., 123 Liberty street, New York, call special attention to the Bartholdi automatic gas lighter. They carry in stock a complete assortment of frictional machines, Rhumkorff coils, dynamo gas lighting torches, electric attachments for incandescent lights, etc.

JULIUS ANDRAE & SONS CO., Milwaukee, Wis., say their catalogue No. 10 tells why the Andrae telephone never disappoints. It may be obtained on request.

THE GLOBE GAS LIGHT CO., 77 Union street, Boston, Mass., advertise the Globe blow torch as the best means for soldering joints. A brief description of it is given in which its indestructibility and the excellence of the materials used in its manufacture are referred to.

THE CLEVELAND ELECTRIC TRADING CO., Cuyahoga Bldg., Cleveland, Ohio, list a few things in order to show at what prices they are offering lamps, dynamos and motors.

DIEHL MFG. CO., Elizabeth, N. J., advertise exhaust fans for all circuits except alternating. They are equipped with fireproof speed regulators of the most improved type.

THE MONARCH STOVE & MFG. CO., Mansfield, Ohio, claim to have solved the snow problem with the introduction of the Monarch adjustable track cleaner. It is in use by some of the best roads in the country and stands the test of most of the criticism of mechanical engineers.

THE ELECTRIC APPLIANCE CO., 242 Madison street, Chicago, Ill., have brought out a new catalogue of the Anchor switches, of which they are Western agents. It is now ready for distribution.

THE GENERAL ELECTRIC CO., New York, devote their space this week to a description of their belt driven railway generators.

THE AMERICAN PEGAMOID CO., 346 Broadway, New York, describe the "Pegamoid" products and refer to their several merits.

THE HART & HEGEMAN MFG. CO., Hartford, Conn., say that no one can afford to take chances with inferior switches and contrast the "Hart Standard" with the "cheap" class.

THE LEA MFG. CO., Elwood, Indiana, advertise arc lamps for various circuits. They are said to embody but few parts, to be graceful in design and to regulate perfectly.

WESTERN NOTES

THE M. C. BULLOCK MANUFACTURING CO., Chicago, Ill., report the past sixty days as a busy period. Orders for Diamond drill supplies from the North and Northwest are strong indications of activity attendant upon development work and forecast a large business to houses furnishing supplies to that district. Rock drills for mining purposes are always in demand, but just now there is an increased call which augurs well for the future, and the company have placed a number of Monarch drills in entirely new fields. Though foreign orders have been generally withheld during the war, they have received orders for four refrigerator plants and the promise of others. Orders have also been received for two central valve engines, to be coupled direct to dynamos, one for lighting and the other for power transmission. With a goodly number of orders on hand and more promised, the business outlook from the company's point of view is encouraging, and they are preparing their works and force to meet a heavy demand for the various lines of their manufacture.

CONTENTS.

EDITORIALS:
Echoes of the Street Railway Convention 256
The Work and Needs of Our Patent Office 257
ELECTRIC TRANSPORTATION:
The Akron, Cleveland & Bedford Railroad Co. (illustr.) 245
C. B. Fairchild. 245
The Lorain & Cleveland Railway (illustr.) ..... C. B. Fairchild. 247
The Carrying of United States Mail Matter on Interurban and Street Railways ..... W. S. Dimmock. 250
Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use (illustr.) ..... Richard McCulloch. 251
Equipment and Maintenance of Electric Cars—I..... M. S. Hopkins. 255
SOCIETY AND CLUB NOTES:
Seventeenth Annual Meeting of the American Street Railway Association, Boston, Sept. 6-9, 1898 258
Convention Notes 260
Exhibit Notes (illustr.) 261
Independent Telephone Association Meeting.—The Street Railway Accountants' Association Meeting.—The Maritime Electrical Association.—Association of the Edison Illuminating Companies 271
Free Guide Book 272
LETTERS TO THE EDITOR:
Spiral Versus Coil Springs ..... Lamar Lyndon. 272
Some Modern Brush Holders ..... D. W. Barnes. 272
Moribund Manhattan ..... Charles Campbell, Jr. 272
EDUCATIONAL:
Electrical Engineering Course at Drexel Institute 272
LEGAL NOTES:
Triumph Electric Co. 272
NEWS AND NOTES:
Twentieth Annual Clambake of the American Electrical Works, of Phillipsdale, R. I. (illustr.).—Souvenir Number of the Street Railway Journal 273
American Rail Joint Mfg. Co., Cleveland, O. (illustr.) 274
PERSONAL:
Mr. Morgan Brooks.—Mr. William Hand Brown, Jr. 274
THE STOCK MARKET:
Lower Prices and Higher Money 274
TRADE NOTES AND NOVELTIES:
India Mica and Micanite (illustr.).—G. C. Kuhlman Car Co., Cleveland, O. 276
Ruprecht Electric Co., Cleveland, O.—The Forest City Electric Co., Cleveland, O. (illustr.) 277
General Electric Co.'s 160 H. P. (G. E.-55) Motor (illustr.).—Large Orders for the C & C Electric Co. 278
A $1,000 First Mortgage, Five Per cent. "Plastic Rail Bond."—New Standard Dry Battery.—The William Powell Co.—New Machine Shops for Beaman & Smith.—Russell & Officer Automatic Switch.—The Niles Tool Works' Handsome Catalogue.—Anchor Electric Specialties 279
Builders' Iron Foundry.—New York Notes.—Advertisers' Hints.—Western Notes 280

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. SEPTEMBER 22, 1898. No. 542.

MISCELLANEOUS

Consideration of the Multiphase System for Central Station Service.

BY W. S. KELLEY.

MARKED success has in recent years attended the design and construction of multiphase induction motors, and in practical service they have achieved most satisfactory results. This was the one thing needful to make a single electrical circuit practically universal in its application to central station service. It is now possible with a single multiphase alternating current dynamo to furnish in a satisfactory manner all three classes of central station service, viz., arc lighting, incandescent lighting and power. The simplicity of such a generating plant is immediately apparent. No argument is required for its full appreciation by the central station manager. But alternating current distribution has in the past been very inefficient, and involving three separate and distinct features, viz., primary lines, transformer and secondary lines, it must of necessity be somewhat complex.

The distribution service, therefore, is a most important factor; in truth, it is the dominating factor in the situation, and this discussion is the result of a critical examination of the subject to determine the system and methods that will assure simplicity, uniformity and efficiency in the highest degree. From the standpoint of light and power equally available at all points, the subject will be treated along the following lines:

Section A—Conditions for the most efficient distribution service.

Section B—How these conditions will be met by multiphase alternating systems of current supply.

Section C—Conclusions drawn from preceding discussion, with the recommendations as to system and methods.

SECTION A.—CONDITIONS FOR THE MOST EFFICIENT DISTRIBUTION SERVICE.

The excellence of any system or method must be judged by commercial results. This fact, too often lost sight of, is of paramount importance, and in this discussion is kept constantly in view. Its technical statement applied to electrical supply is: That service is the best in which the ratio of current paid for to current output is the greatest. This means that losses must be reduced to a minimum. One factor in attaining a high ratio of pay current to current output is in restricting losses to the period of remunerative load. This factor has its highest realization in the Edison central station low-tension system of distribution. Here, with no load, no electrical losses are sustained; with light loads (which, especially with incandescent lighting, continue the greatest number of hours in the twenty-four), very high efficiency in distribution is obtained; maximum loss in distribution is sustained only for the brief period of maximum load, when, of course, it can be best afforded.

A low-tension system, however, is restricted as to distance, and the demand for incandescent lighting over more extended areas and where business was lighter than could be commercially reached from a direct current station resulted in the development and introduction of the high tension alternating system of distribution, with individual transformers at each service point; necessities of the system dictated the use of a low tension lamp (52 volts) and consequently a proportionately large number of small transformers. The small transformer, however, is a most uneconomical piece of apparatus to use, and, since the development of engines, dynamos and their management now allows a sufficiently uniform voltage to be maintained to admit of the use of higher voltage lamps, it has become more and more apparent that the commercial salvation of the alternating system demanded a radical change in its methods.

An efficient system of high tension service was handicapped by very wasteful methods of distribution. A low tension secondary distribution, covering large areas from carefully selected centres, with high tension feeders, are the necessary conditions of the highest possible economy in supplyng a large territory from a single generating station. This leads to a consideration of the relative as well as absolute efficiency of transformers.

To give point to these statements, it may be stated that the best 1,000-watt 60-cycle transformers (20 50-watt lamps) to be had to-day have a continual no-load loss that is over half the loss at full load; with transformers at 5,000 to 20,000 watts capacity, the ratio is about 50 per cent.

Comparing the results with such transformers with those obtained with a continuous current, low tension system, assuming 10 per cent. loss at maximum load, continued for two hours in each case, we have the following results on twenty-four hour basis:

LOSSES IN WATT HOURS.

	Alternating Transformer.	Continuous Current Low Tension.	Ratio.
1,000 watt output	768	200	.26
5,000 watt output	2,022	1,000	.49
10,000 watt output	4,000	2,000	.50
20,000 watt output	6,550	4,000	.61
30,000 watt output	9,250	6,000	.647

(Older types of transformers would show much poorer results in comparison.)

This table points to very much improved results by the use of large transformers, and experience proves the correctness

DIAGRAM No. 1

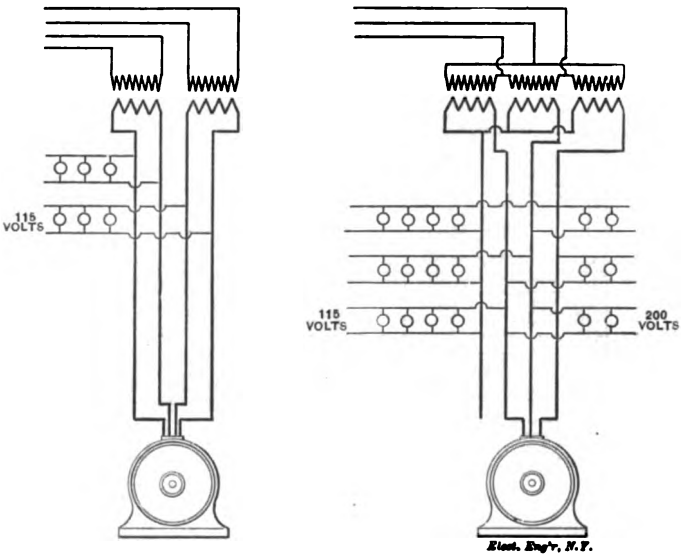


Fig. 1 Fig. 2

of the deduction. One station that recently substituted eight modern 6,000 watt transformers for twenty-five smaller ones of various makes reports a saving of 8 to 10 watts on 1,100 volts. Another substituted 152 transformers (13,496 lamp capacity) for 519 (21,485 lamp capacity), increasing the lamps connected from 16,360 to 20,189, and their income per kilowatt hour at switchboard from 4.38 cents to 12.4 cents (183 per cent.). Another substituted 18 new transformers (1,624 lamp capacity) for 57 old ones (1,499 lamp capacity), decreasing their core loss by the change, 77.5 per cent., or at 1⅓ cents per kilowatt hour, saving $527.70 per year, sufficient to pay for the change in a year and a half. Another substituted three transformers (400 lamp capacity), for 81 transformers (880 lamp capacity), reducing core loss from 2,568 watts to 280 watts, and at 1⅓ cents per kilowatt hour, effecting a saving sufficient to pay for these new transformers in 8½ months.

It will not be necessary to multiply these instances further. These somewhat startling results, while attained by using larger and better transformers than formerly, cannot be attributed entirely to improved transformer efficiency; much of the gain is

Digitized by Google

due to the introduction of an improved system of secondary distribution. Large transformers mean longer distances; therefore only by an economical system of secondary distribution is it possible to secure the advantage incident to the use of larger transformers. This leads to the enunciation of a principle of paramount importance in the situation under discussion.

Principle No. 1.—Other things being equal, that multiphase system is the most desirable for adoption that offers the most economical method of secondary distribution for both lights and power.

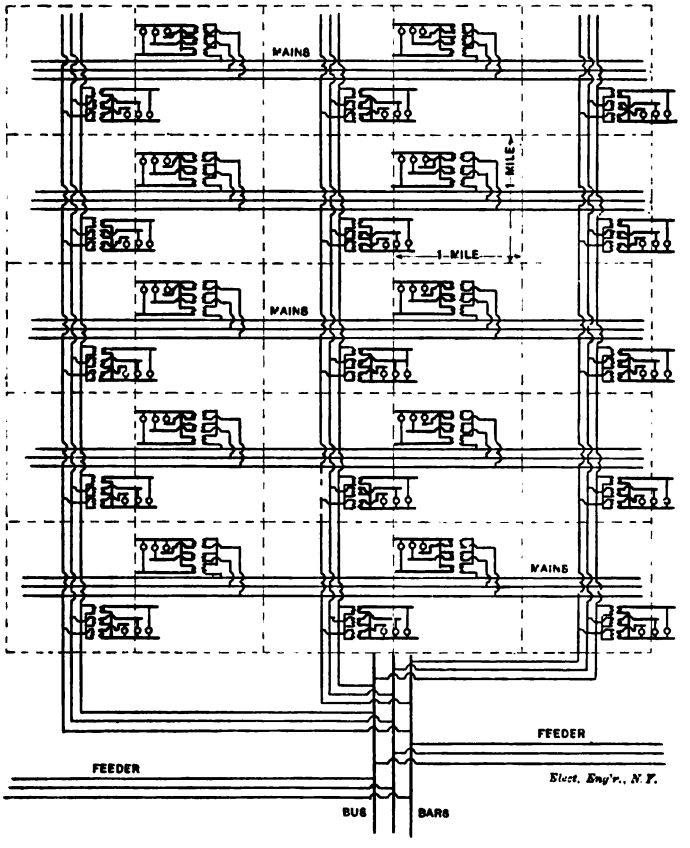
A connected secondary network, covering a large area and fed at numerous points, will prove an important factor in maintaining a perfectly uniform voltage, which, next to uninterrupted service, is essential to a satisfactory electric supply.

As the degree of satisfaction afforded the customer by an electric lighting service is an important factor in promoting its more extended use, a system must be judged to a considerable extent from the point of view of satisfactory service. Hence:

Principle No. 2.—That system is the most desirable for adoption that secures the most uniform voltage at the lamp, also at the motors, which is just as important.

With transformers properly grouped to supply considerable

DIAGRAM No. 2



areas, the primary distribution is resolved into a comparatively simple system of two parts; first, a network of mains reaching all transformers, and second, feeders connected in multiple between switchboard and points on the main selected for the purpose of maintaining uniform voltage over the system. As the feeders will be of considerable length, and carry in the aggregate a heavy output, the investment in copper becomes a serious consideration. Hence:

Principle No. 3.—That multiphase system is the most desirable for adoption that will carry a given current at a given loss with the least weight of copper.

One of the conditions imposed is that the system will carry motors with equal facility as lights. This warrants the assumption that ultimately a power service will be provided, at least at each centre of secondary distribution. All primary mains and feeders must on this assumption provide both for light and power. Hence:

Principle No. 4.—That multiphase system is the most desirable for adoption that provides the simplest primary wiring for combined light and power service.

SECTION B.—HOW THESE CONDITIONS WILL BE MET BY MULTIPHASE ALTERNATING SYSTEMS OF CURRENT SUPPLY.

For lights alone the service obtainable from a single-phase system of distribution leaves nothing to be desired in comparison with any other alternating system. Therefore as the reason for a multiphase system is to secure a satisfactory power service, the one that will provide this at all points in the most satisfactory and economical manner is the one most desirable to adopt, other things being equal. If, in addition to this, one of the two multiphase systems to be considered has other points of advantage without corresponding disadvantages, there would seem to be no question as to its adoption.

The only multiphase systems to be considered are the two-phase and the three-phase.

For two reasons the interlinked, two-phase, three-wire system has proved so exceedingly unsatisfactory in practice that it is not to be recommended. With a brief statement of these reasons, this method of two-phase wiring will be barred further consideration. As the two electromotive forces in the two two-wire leads of the two-phase (or quarter-phase, designated hereafter Q. P. S.) system are in quadrature, they will remain in quadrature on the third or common return wire. The resultant—on the principle of the relation existing between the sides of a right-angle triangle—is the square root of the sum of the squares of the other two sides. For example, if each component has a maximum potential of 2,000 volts, the resultant or actual potential on the third wire would be 2,828 volts.

If the generator has an inherent regulation of 5 per cent., and the feeders 5 per cent. drop, the drop in the two lines will not necessarily be equal in each 10 per cent., but the self-induction of the system will cause a difference between the two branches, which might in some cases amount to 15 per cent. drop in one and 5 per cent. drop in the other, thus causing a difference of 10 per cent. with an equal distribution of load. This causes a surging of inductances and electromotive forces, and an irregular distribution of current over the whole system.

The three-phase system will hereafter be designated as T. P. S., for convenience. The number of wires and relative weights of copper for primary distribution will be as follows:

PRIMARY DISTRIBUTION.

	For lights alone.	Weight.	For power or power and lights.	Weight.
Q. P. S.	2	1	4	4
T. P. S.	2	1	3	3

For lights alone two wires answer in each case with equal weights of copper.

For power and lights the Q. P. S. requires four wires, while for the same service the T. P. S. requires but three of the same wires.

If there is to be hand regulation of feeders, the fewer feeder lines there are (therefore the fewer points to regulate), the better. With the same weight of copper, three-wire three-phase will carry 33⅓ per cent. more current than a two-wire service. If each of the three wires is of the same cross section as the two would be—and this is likely to occur frequently—the carrying capacity will be 50 per cent. more; it is evident therefore that three-phase feeders would ordinarily provide much greater carrying capacity than two-phase, resulting in fewer feeders upon which to regulate potential.

It is worthy of note that with the T. P. S., both technical and commercial considerations urge the use of like means, impose uniformity in distribution, provide current, at all points, that is available for all purposes, while, with the Q. P. S., these considerations are at variance. The same means will not serve both equally well, hence different methods will be employed as requirements differ.

With the two-phase four wires are required for motor service, but convenience and economy of copper would naturally dictate the use of two wire feeders, so these would doubtless be run in many cases where there seemed to be no present call for power. When a demand comes for motor service on a two-wire feeder, connection must be made with the other pair of wires in quadrature, perhaps a mile distant. Every time this is done, the complexity of the system will be increased; consequently the trouble and cost of maintenance, and in the end

Digitized by Google

there will be an unnecessarily large number of primary lines. A suggestion of the difficulties presented will be found in diagram No. 3.

With two-wire feeders from multiphase service, the balancing —where balancing is required—must take into consideration character as well as amount of load. The different legs should be balanced with the same kind of load. A load of residence lighting on one leg will not balance a like load of commercial lighting. To secure balance, the loads on each must be timed to work together.

With three-phase, motor service requires three wires. Lighting service is better served with three wires (primary feeders) than with two. Copper economy is obtained by using three wires. Three wires eliminate the question of balance. Practically all conditions are better met by three wires than by two. Uniformity in distribution is thus in a measure compelled. It is confidently claimed that in addition to this important feature of simplicity and uniformity in primary distribution, the T. P. S. will assure ultimately fewer primary wires than is possible with the Q. P. S., as well as much less weight of copper.

The advantage of the T. P. S. over the Q. P. S. in number of wires and weight of copper is even more marked in secondary than in primary distribution.

SECONDARY DISTRIBUTION.

	For Lights.	Weight.	For Power.	Weights.	For Power. & Lights	Weight.
Q. P. S...	2	1	4	4	6	31¼
T. P. S...	2	1	3	3	4	29¼

Where two-wire secondary mains are to be used, one system offers no advantage over the other, either in number of wires or weight of copper. If power service only is considered, the three-phase secondary distribution has the same advantage over the two-phase as in the primary distribution, viz., three-quarters the number of wires and three-quarters the weight of copper. It is, however, in the secondary distribution for combined light and power service that the great difference in the two systems is most apparent. As to weight of copper there is little to choose. With weight of simple two-wire distribution as 100, the six-wire Q. P. S. is 31¼, the four-wire T. P. S. is 29¼, a trifling advantage for the latter. As to number of wires, the four-wire T. P. S. is a thoroughly satisfactory commercial method of distribution, as shown by actual practice, easy to install, universal in application, and the most economical in copper of any practicable method, while the six-wire Q. P. S. is none of these; in a word, it is a possible, but an entirely impracticable system. The proper comparison of practicable commercial methods of secondary distribution is as follows:

	No. Wire.	Weights.
Q. P. S.	4	100
T. P. S.	4	29¼

Transformer connection and secondary voltage are shown in diagram No. 1 for each system. If desired, two-wire secondaries may be run in either case for lights alone, with equal facility and equal advantage. As to balance, the advantage has been claimed for the Q. P. S., where the load has to be divided between two pairs of wires, as against a division between three pairs of wires in the T. P. S. Wherever, in order to provide for motor service, the four secondary wires in each case are carried to each local centre of distribution, the economy in copper is very marked, the difference in copper required being almost as four to one.

This four-wire secondary distribution for the T. P. S. is so much superior to 115 volt two-wire distribution for lighting, with straight three-phase, 550 volt secondary distribution for power, that it is not worth while to dwell on the latter, although in itself fully as satisfactory as any secondary distribution possible with the Q. P. S.

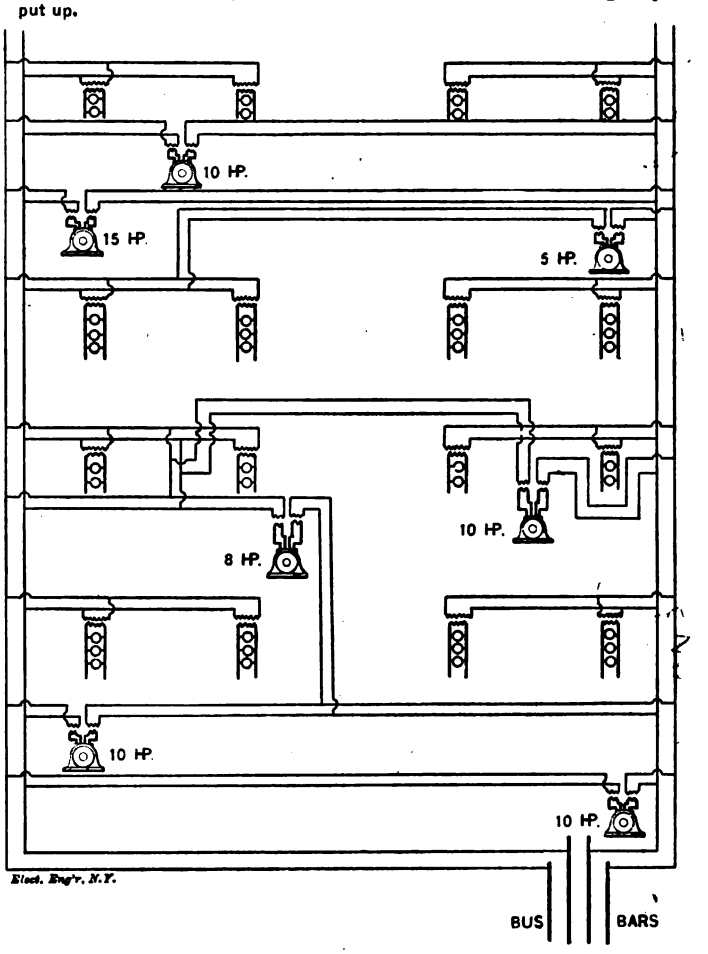
Referring to diagram No. 1, Fig. 2, it is evident by a slight change in the connections of the secondaries, either at the transformers or at a centre of distribution reached by the four secondary wires, the voltage on the wires can be quickly changed from 115 to 200. This allows of changing any individual service from 115 to 200 volts without interfering with any other service.

In view of the present tendency towards the use of higher voltage lamps, the facility with which this change can be effected constitutes a most meritorious feature of the three-phase, four-wire, secondary distribution.

As to motors, there is little to choose between 115 volts and 200 volts. The smaller the investment required to secure a given carrying capacity, the more likely it is that good carrying capacity will be provided in the wires. This means less drop and consequently less variation in the potential. For a transmission line there is no question as to the advantage possessed by the T. P. S. over any other in economy of copper. This discussion has already shown that it offers equal, if not greater, advantages in its secondary distribution over the Q. P. S., with which comparison is being made. The desirability of achieving the results enumerated in the statement of principle No. 1, for lighting service, will be patent to any one, but that uniform potential is equally essential to the satisfactory operation of induction motors is not so well understood. With continuous current motors, speed and current are functions of potential; with induction motors, power and current are functions of potential; speed depends upon periodicity. With the former, a

DIAGRAM No. 3

Example of multiplication and complication of primary mains to accomodate motor service that develops where 2 phase 2 wire feeders were originally put up.



reduction in potential means a little less speed, of course bad to allow. With the latter, if fully loaded, any considerable reduction in potential may bring the motor to a standstill, which is worse; much more detrimental to the service. This is due to the fact that the torque drops off as the square of the voltage; hence for motor as well as lighting service, voltage is a very important consideration. This is secured by the T. P. S. for a very much less investment in copper than is possible with the Q. P. S., employing any commercially practicable method of distribution.

By a judicious selection of transformer locations, the three-phase, four-wire, secondary network can be tied together, over large areas, with great advantage. Its great economy of copper allows of doing this, and still using large transformers. To this, more than to any other one thing, the system owes its great advantage in maintaining uniformity of potential. With a connected secondary network there are in addition many incidental advantages: Trouble with transformers is minimized, as an overload at a given point is not imposed on a single transformer,

Digitized by Google

but draws current from transformers in all directions. If any trouble should develop with a single set of transformers, they could be cut out without interruption of service. Such a connected secondary network of course requires extra precautions against grounding, and care in guarding against bad results when it occurs by carefully fusing both primary and secondary connections. Here, as elsewhere and always, refinement in method demands higher ability to develop and greater vigilance to maintain. This is the inevitable price of more efficient operation and better results.

I have endeavored in what has preceded to point out the essentials to be secured in the adoption of a multiphase system. I have examined the two systems under discussion, with respect to how they can supply these essentials. In a number of respects the two systems will presumably give equally satisfactory results. The question of balance has been a mooted one. Advantages have been claimed for the Q. P. S., and only recent experience has proved to the contrary. This claim has been tacitly acquiesced in. This question has now, however, been settled by results obtained in actual practice. It has been found that instead of being inferior to the Q. P. S. in regard to balance, the T. P. S. requires even less attention given to the question of balance.

Aside from the question of balance, the superior advantages of the T. P. S. over the Q. P. S. are manifest at all points, so clearly as to be almost beyond dispute.

SECTION C.—CONCLUSION.

If the principles stated at the outset are admitted, the application of facts that has been made allows of only one conclusion.

It has been shown that the T. P. S. "offers the most economical secondary distribution for both light and power." By this is obtained (a) the use of large and efficient transformers; (b) a consequent reduction in the number of places where trouble may develop and burn-outs occur.

It has been shown that the T. P. S. offers best conditions for maintaining "uniform voltage at the lamps and at the motors." By this is obtained (a) ability to use the most efficient lamps; (b) the longest life for such lamps; (c) the least cost to customers for a given amount of illumination; hence, (d) rapid increase of service must result where the light is satisfactory and relatively cheap.

It has been shown that the T. P. S. "will carry a given current at a given loss with the least weight of copper;" also that it "provides the simplest primary wiring for combined light and power service. It therefore insures (a) minimum investment in line wires; (b) minimum cost in running wire; (c) reduced cost of maintenance; (d) less liability of trouble from breaks in primary feeders.

It has long been recognized that for power service the T. P. S. is superior to the Q. P. S., and the considerations advanced herein seem conclusive as to its superiority for a combined lighting and power service. Competent engineers, who have had personal charge of both systems in actual operation, are very pronounced in their opinion that for lighting, as well as power, the three-phase system has decided advantages over the two-phase.

The Illegitimate Watt.

BY JACQUE L. MORGAN.

THE recent disappearance of the Rev. P. F. Jernegan, the erstwhile promoter and expert of the Electrolytic Marine Salts Company, and despoiler of our argentinic and auriferous seas and oceans, brings to mind the researches of other notorious sensationalists. That love of the marvelous shared by the nations of the earth in common, and by Americans in preferred stock, has been the capital of many a wily promoter.

While Jernegan only transferred electrolytically $338,378.40 from the pockets of the stockholders to his own, the more lucrative efforts of Keeley and his motor, and of Pennock of battery fame, are still fresh in our minds. Although the antediluvian electric belt scientist still continues to charge his harness up to the proper voltage with red pepper, and the electric bottleman is content to use essential oil of mustard, without fuse blocks or lightning arresters, as his "subtile fluid," and the electric hair brush man, with permanent magnets concealed in the handle of the brush, is happy in the delusion that the little compass included in his outfit demonstrates his therapeutic claims, there has sprung up a newer and smarter element of fakirs, whose applications of the current are more dangerous, and who are bringing the earnest, honest and hustling little watt into disrepute.

Nowadays the dishonest jockey simply lets his mount loaf along till he is into the stretch, when he connects his noble steed with a few hundred miles of secondary from a step-up coil and the effect is instantaneous. The enterprising burglar now discards the "jimmy" and drill and carries a few feet of wire and a large carbon which he shoves into the safe in the direction the money is most liable to be.

The "look-out" of the roulette game now has his switchboard to mind. Concealed under the arm of his chair are buttons corresponding to the red, black, odd, even, high, low, and also rows of numbers. These buttons connect by commutators to electro-magnets on the wheel, the ivory ball having a soft iron core of high permeability, and the way the "look-out" can "copper" all bets is beautiful. In all the history of electrical engineering, there has been probably no piece of metal placed where its intrinsic value is appreciated like the busy little core of the roulette ball.

The electeric bitters, tonics and waters exist without number, but it remained for Kelsey, Kan., to have a truly electric spring. This spring was owned by the local "locksmith and electrician," and for a time did a thriving business. Knives were magnetized until the nails in the floor of the corner grocery were almost pulled out when there was a full attendance of the chronic whittlers. But the unfeeling, unprincipled, unhung owner, was discovered filling his batteries in an adjacent shed and the subsequent finding of a solenoid around the spring exploded the magnetic theory, and was the immediate cause of a large number of invalids again losing their health.

The writer had a ludicrous experience with one of these fakirs some months ago. As city electrician I received a telephone call from a doctor in one of the large office buildings to come and inspect an "electric lounge." I had never heard of an electric lounge, but putting on a bold front and a look of infinite wisdom, I knocked at the office door. I was admitted by the doctor, and he "looked the part." Tall, melancholic and dressed in sombre black, he looked the typical wizard, and although his long Prince Albert coat, negligé shirt and lay-down collar were a bit odd, his horn spectacles and curly wig gave him a look that was not soon to be forgotten. After showing me the mechanism of the lounge, which consisted of thirty-two electro-magnets underneath the surface, he explained that with the double throw switch he could get a steady stream of magnetic lines through your system, much like you would squirt water on a chained dog, or with the other throw of the switch you get the short arm jab effect derived from the alternating current. All that he wanted was a certificate stating that it was a good and safe institution to patronize, which no doubt it was, as he told me that he had reclined all morning on the lounge and that the effect was marvelous. Upon closer examination I saw that one of the wires was disconnected. The wily contractor had simply wound the magnets with any old scrap wire he happened to have and then left the circuit open, knowing that the machine was as potent without the current as with it. An employee of the firm that made the machine was present, and at my suggestion he reluctantly closed the circuit and threw the switch on the "short arm jab" side of the switch for a trial trip. And the effect was marvelous. The thirty-two magnets vaporized like shots from a rapid-fire six-pounder, the excelsior stuffing took fire, and to all this the doctor danced wildly and howled, "Turn her off!" "Turn her off!" The device was getting its current from a keyed socket on the chandelier, and although it was working grandly, I turned the key, but the current was too heavy to be broken by such a small "break" so we had pyrotechnics at two places.

When the current was finally turned off and the room cleared of the dense white smoke from the excelsior and the sickening fumes from the burnt shellac and varnish, an inventory showed one electric lounge in a wreck, a chandelier in the same condition, a tremendous heap of law books in the area way, where they had been thrown by an excited tenant, two music teachers and a voice culturist in a swoon, and a very mad and disgusted doctor.

A LEWISTON (Me.) motorman found his trolley car stalled two miles from the city, as the result of a fuse burning out, and no copper wire at hand to repair the damage. He borrowed a hairpin from one of the female passengers, and by its use got his carload of fifty passengers to their destination.

Digitized by Google

THE CROSS-COUNTRY ROADS AT CLEVELAND, OHIO.—III.

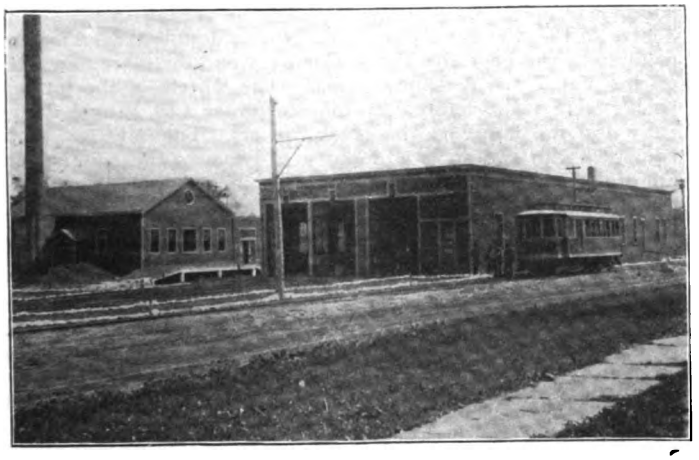
(Concluded.)

BY C. B. FAIRCHILD.

Cleveland & Chagrin Falls Electric R. R. Co.

THE line of this company was next to the last to be constructed of the five roads of this class reaching out from Cleveland and is the shortest one of all, being only 14 miles in length from the city line of Cleveland. It was opened in May, 1897, and extends in an almost easterly direction and terminates at present at Chagrin Falls, a village which has grown up about the Falls in the Chagrin River, from which it takes its name. The region through which it runs is level or gently rolling without any severe grades, the highest point of ground being found midway between the terminals, from which the grade descends equally in both directions. For nine miles out of Cleveland the line is through a thickly settled farming region, while for the remaining five miles it follows the channel of a small stream on a private right of way forty feet in width, and is bordered on either side by wild woods, broken occasionally by the abrupt walls of shale rock, through which the stream has cut its channel. The diversity of scenery produced by this condition makes the line an unusually attractive and instructive one for pleasure-seekers.

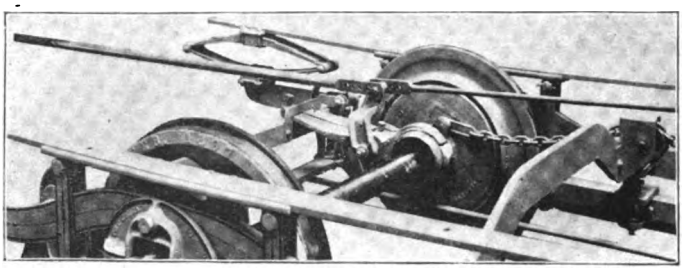
BEE FARM ON C. & C. F. E. R. R.



POWER HOUSE AT CHAGRIN FALLS, C. & C. F. R. R.

One who has never given the subject much thought can hardly appreciate the advantages for study and pleasure that is presented to the inhabitants, and especially to the children, of such a city as Cleveland, making it possible for them at the cost of a few cents to get a change from the cramped life of the city to the wide expanse of country with a great variety of products and methods of farming with an equal variety of forest trees, shrubs and wild fruits.

It is so seldom that one finds a farming region with such a variety of products that we are induced to give a partial list in order to emphasize the educational advantages of this class of roads to the denizens of the city. Among the fruits are found extensive orchards of apples, pears, cherries, interspersed occasionally with a vineyard, while the pretty farm houses are shaded with magnificent specimens of maple and elm trees with pretty lawns and flower beds. The farming region embraces great areas of corn, oats, wheat and grass fields promiscuously intermingled. Later in the season fields of buckwheat with the various colors of autumn leaves mark still another change in the pleasing landscape. The farming is not all confined to grain, however; there is occasionally a dairy farm with its numerous outbuildings and windmill towers, and about the buildings are hay stacks and stacks of grain. There are also sheep farms and a few which raise blooded stock, and now and then a chicken and bee farm, with of course extensive truck farms near the city limits of Cleveland. Not only the farms and scenery help to make up the educational features, but there is farming machinery to be seen in operation, including mowing, reaping and threshing machines operated by both steam and horse power, while in the wooded region there are numerous slashings with piles of cordwood that remind one of primitive methods or the days when the region was first settled. An occasional stone quarry and brick yard adds still other industrial features, while all along the route may be seen country churches, school houses, creameries and not a few old-time country taverns and country stores. Added to the natural features the company have improved an extensive park known as Horse Shoe Glen, which is located near the entrance of the line upon the private right of way. Here a siding and loop has been constructed so that excursion trains can deliver their passengers directly into the grounds, near a dancing pavilion, which has been erected by the company.

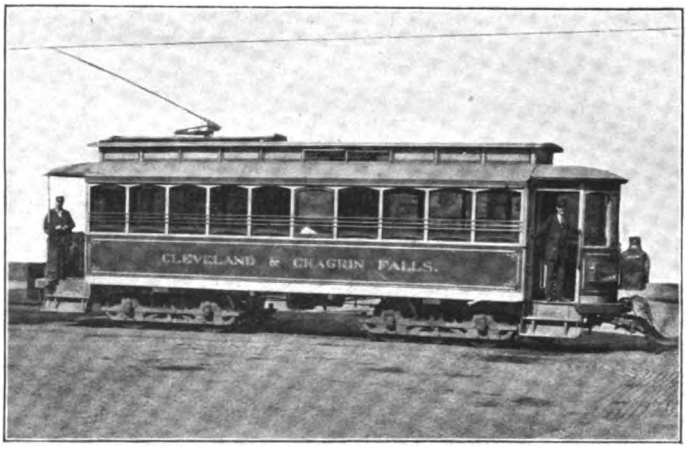


PRICE MOMENTUM BRAKE USED ON C. & C. F. ELECTRIC R. R.

The cars are usually run on a headway of one hour, except on Saturdays, Sundays and holidays, when the headway is forty minutes, and the time consumed between the terminals, including the four miles within the city limits of Cleveland, is one hour, when the cars are run forty minutes headway, and forty-five minutes on other days. The fare for the round trip is 60 cents, and 100 mile mileage books are sold for $2. There are also special rate tickets that are good for sixty days. Ordinarily the cars are run until 10.30 at night; on theatre nights and on special occasions, they run until 12.30.

ROADBED AND OVERHEAD CONSTRUCTION.

The ground is slightly turnpike for the reception of the ties and rails; the latter are large and spaced two feet centres and a sixty-pound T-rail is employed. The line has not yet been ballasted throughout its entire length. There are five turnout sidings with spring switches, and at these points telephones are



CAR OF CLEVELAND & CHAGRIN FALLS R. R.

Digitized by Google

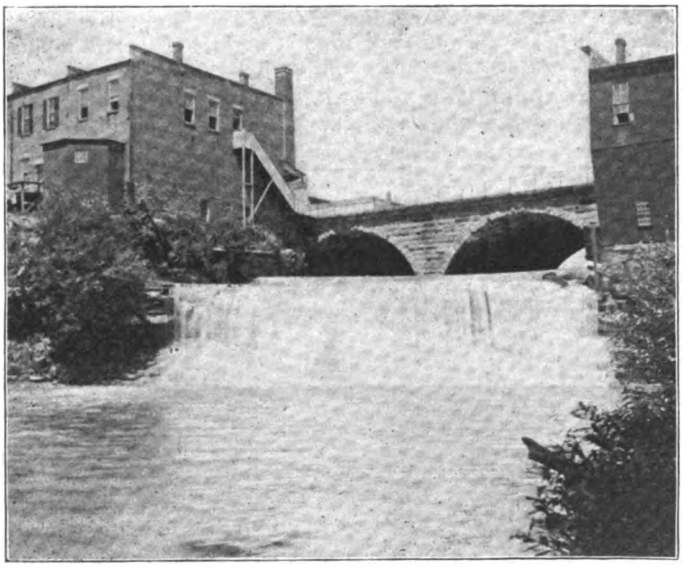
located by means of which conductors report and receive their orders, one conductor getting the orders for both cars. A starter keeps a record of the cars by means of checks and issues directions for the movement of each car. The rails are heavily bonded and on a portion of the line the Protected rail bond manufactured by the Forest City Electric Co. was employed. On the remaining part of the line bonds furnished by the Roebling Co. were used. Wooden side poles with brackets support

TYPICAL FARM HOUSE ON LINE OF C. & C. F. E. R. R.

the trolley wire and feed wire, as in the case of some of the other roads. The company were required to build a number of small bridges and culverts, while near Chagrin Falls the line crosses the river canyon on a steel arch county bridge, which the railroad company keeps lighted and clean for the privilege of crossing.

POWER STATION.

The current is derived from one station which is located near the terminal of the line at Chagrin Falls. This is a wooden structure, and near by is a car house and repair shop, also of wood. In one portion of the latter building are the office of the electrician and starter and waiting rooms for the employees. The power equipment consists of return tubular boilers of 500 h. p. capacity, manufactured by Russell & Company, of Massillon, O., and two simple four-valve engines manufactured by the same company. These have cylinders 17x24 inches and make 150 revolutions per minute, having a rated horse power of 225 each. These are each belted direct to a Walker generator of 150 kilowatts capacity. The plant is working in a highly satisfactory manner, notwithstanding the fact that the load is all on



CHAGRIN FALLS ON LINE OF C. & C. F. E. R. R.

or all off suddenly at times, due to the peculiar grade of the line, as described above.

The switchboard is of black marble, polished, and is provided with Walker switches and instruments, with the exception of the meters, which were manufactured by the Weston Electrical Instrument Company, of Newark, N. J. Owing to the location of the station the current covers the entire distance of fourteen miles. The location was chosen, however, because of a contemplated extension, the grading for which is now under way. This will include a line to Burton, nearly due east from Chagrin Falls and about fourteen miles distant. This extension will be operated from the same power station, there being room for an additional equipment. During the heavy traffic on Saturdays and Sundays, both engines are run together, but on other days one engine is sufficient to handle the road.

ROLLING STOCK.

The car equipment consists of eight eight-wheel cars, all of which were built by the G. C. Kuhlman Company, of Cleveland. Six of these are coaches and two have compartments for freight and express, also smoking compartments. Small parcels, however, are carried on any of the cars. The car bodies are 38 feet over all and are exceptionally well built. The interior finish is of mahogany, with bird's-eye maple ceiling. The cars are built with double floors, the seating is the same as employed in steam cars, and in part of the cars the upholstering is of cherry-colored plush and on the others it is old gold. The toilet closet and ice water tank complete the interior equipment. The exterior is painted a lemon yellow, with black lettering and decorations.

The cars are equipped with home-made electric heaters, and two of these are placed in the vestibules. The heaters are made by winding coils of spirally wound wire around porcelain rods which are about 18 inches long and 3 inches in diameter. These are made with spiral grooves, in which the resistance coil is placed; these being mounted with suitable screens under the seats prove very efficient. Great care is taken in the construction of these heaters to insure that the coils in each one are of uniform length.

Five of the cars are mounted on No. 14 double trucks manufactured by the Peckham Truck Company and three are mounted on the Van Dorn & Dutton truck. The wheels of the former trucks were manufactured by the Rochester Car Wheel Company and the latter by the truck makers. The cars are each equipped with two 50 h. p. motors, and five of the equipments are of the Walker type and three the Johnson Company's manuture. The cars are also each equipped with the Providence fender. Seven of the cars are provided with friction power brakes of the Murray type, which are manufactured by Charles Hathaway & Co., of Cleveland, O. There is also one car equipped with the Price momentum street car brake, which was invented and manufactured by W. G. Price, of Chicago. These are said to be working in a highly satisfactory manner and are much cheaper, it is claimed, in installation than either the air or electric brakes. The speed of the cars is usually about twenty miles per hour.

The headlights are of the United States pattern manufactured in Syracuse. There is also a case for illuminated signs placed on the dashboard. This is provided with an incandescent lamp, and there are two slides into which the signs may be placed, a shield being placed in the opposite space. A snow plough manufactured by the Taunton Locomotive Works, together with necessary construction cars, completes the rolling stock equipment. This snow plough is said to have proved very efficient in keeping the line open during the winter.

TRAFFIC.

During the first year of operation the line carried 214,537 people and the receipts for freight and express amounted to a creditable sum. The milk trade for July of the present year has increased 400 per cent. over that of a year ago, and the increase in freight receipts is also striking, that for July, 1897, being $115 and for the present year $273, showing how this class of railways create their own traffic. The freight charge for milk is 1½ cents per gallon, and about 100 cans per day are handled. For handling the freight and express the company employ their own messenger. In the matter of picnic and excursion parties this company follows the practice of other lines and advertises freely and caters to this class of traffic.

OFFICIALS.

The president of the company is Mr. V. A. Taylor, a resident of Bedford, who was active in the organization of the company and the construction of the road. Mr. R. L. Palmer is the present general manager and has been identified with the scheme from its inception, as he was the first to conceive of the project and was active in the organization of the company.

Digitized by Google

Equipment and Maintenance of Electric Cars.—II.

(Concluded.)

BY M. S. HOPKINS.

MAINTENANCE OF EQUIPMENT.

THE cost of maintaining equipment depends on various complex conditions, some of which are beyond control of the manager, and others for which he should be directly responsible. Heavy grades, numerous railway crossings, sharp curves, dirty and unpaved streets, imperfect and poorly constructed equipment, long and severe winters, all affect cost of maintenance unfavorably and are beyond control of the manager. But the character of men who operate the cars, the manner of operation, the way in which repairs are made, the character of men engaged in repairs, and the material used, are the controllable elements, and in most instances the chief features affecting maintenance.

CARE OF EQUIPMENT IN CAR HOUSES.

Generally one of the following three methods are used for daily inspection of car equipment, namely, inspection of cars for each trip, inspection of equipment at night by motor inspectors, inspection of equipment during the day by motor inspectors and repair men.

In regard to the first case, that of the trip inspection, I would say that in the present degree of perfection attained by manufacturers of railway equipment, trip inspection should not be necessary, and, excepting on interurban lines operating at high speed over long runs, is of doubtful value. It is expensive, requiring the services of an inspector who is necessarily a man of some ability for each line of cars. In regard to night inspection, the experience of the writer has been such as to absolutely condemn such a method as expensive, slovenly and unsatisfactory.

For making inspection and running repairs such as should be made in car houses, it is a safe rule to have one man to seven cars. It is important, however, to have in all car stations a man known as chief inspector of that division, who is thoroughly conversant with practical electrical and mechanical matters. This chief inspector should have under his care for inspection and repairs seven cars and also have direction and supervision of the other two repair men who care for the remaining eighteen cars.

The actual repair work done by these inspectors should be all work possible to be done without the use of machine tools, or which, if done by them, will not require the loss of the car from service for a period of more than two hours.

The question as to how often car equipment should be taken to the shops for a general inspection and overhauling, and to what tests the electric equipment should be given at the time of inspection are subjects upon which electrical engineers widely differ. Considering the average conditions, and assuming that the equipment is in good condition, it is the opinion of the writer that the taking of cars to shops once every six months should maintain the equipment in good condition and assure its efficient operation.

MOTOR BEARINGS.

Bearings should be run "close" at all times, and the time of their renewal should be determined by the effect of the wear on the gear and pinion, as the wear on these parts is largely affected by the wear of the bearings.

After a series of tests covering quite a period of time, as to the wear of various materials used in motor bearings, the writer feels warranted in making the statement that under the ordinary conditions either the best grade of babbitt or brass bearings should give a longer life than six months, and when a bronze bearing of the proper mixture is used and properly lubricated a life of twelve months can safely be expected. The method of lubrication largely affects the life of brasses. After long tests with various lubricants the writer has discontinued entirely the use of grease on armature brasses, and in most cases on axle brasses, a good grade of engine oil, supplied through wicks, being more satisfactory and economical.

Rough and burnt commutators are too frequently the cause of expensive motor repairs, and usually indicate imperfect motor design or inexcusable neglect. Well designed motors in good condition, even under the hardest service, should not require turning oftener than once in eight months, provided, of course, the average work is within the rated capacity of the motor.

The kind of brush used is an important factor. Brushes should be of soft, close-grained carbon treated with a good lubricating compound—one which does not flow too freely from the heat from the motor, and which will not burn and carbonize on commutator. The price of the brush is not a material consideration, as a brush which is slightly superior to another will prove economical even at quite a large increase in first cost. As a rule the tension on the brushes of railway motors is too light. It is a common belief that heavy tension causes wear of the commutator, but experience has shown that the actual wear of commutators, due to the friction of the brush, is very small, and that in some cases increased tension will materially decrease the sparking, which causes the greatest wear. Improper alignment of brush holders also frequently causes sparking. In recent practice the use of side contact springs on brushes has been generally abandoned. On motors carrying heavy currents this spring is quite essential, as the excessive heating of the brushes is caused by limited contact in the holder.

Commutator insulation should be made of what is known as the built-up mica segments of the very softest grade of amber mica. A hard, clear mica should never be used in the commutator, as this mica will not wear away as fast as the copper, and there is nothing so disastrous to the life of the commutator as high mica insulation.

In some motors it may be necessary to change the winding of the armature and field coils in order to avoid the burning of the commutator. First, determine by actual experiment what change in winding is necessary, and then equip with the new, winding every armature or field that comes in burned out. The change can thus be made without any great expense, as the greatest part will be borne by the maintenance charge.

THE ELECTRICAL TESTING OF RAILWAY EQUIPMENT.

Elaborate systems for the periodical testing of insulation on railway equipment seem to be growing in favor with some electrical engineers, but the practical value of these elaborate tests is not fully demonstrated.

Judging from my own experience, it is neither necessary nor advisable to test periodically the insulation on the equipment, but to make such tests only in cases where the motors are not working properly. The proper training of motor inspectors as to the little points about railway equipment which clearly indicate trouble with motor, will locate in nearly all cases trouble due to weak insulation, so that it can be remedied before any serious damage has resulted to any other part of the equipment.

All armatures and field coils repaired should be carefully tested as to resistance and insulation to ground, and on all armatures having coils repaired, new commutator put on or commutator turned, the resistance between commutator bars should be very carefully measured. This should be done preferably with a portable Wheatstone bridge testing-set, capable of showing clearly a variation in resistance of 0.001 ohm. This is one of the most important tests to be made in the care of railway equipment, as more burn-outs of armatures are caused by the slight, short-circuiting of coils, due to the bridging over of insulation between bars by solder, acid or copper turnings under the leads, than from any other cause. These defects can be located only by a test of this kind. A bad joint or any mistake in connecting up the leads will be detected at once before any damage has been done. For testing insulation to ground I consider a first-class magneto of 10,000 ohms resistance all that is necessary.

CAR WHEELS.

Much has been written of late on the subject of car wheels, their wear and alignment, and still street railway managers are careless about their wheels. Too much care cannot be given to the sizing and alignment of wheels and the pressure with which they are forced on the axle. At least 50 per cent. of the wheel removals throughout the country are caused by broken or sharp flanges or a broken wheel. The use of sand influences largely the life of wheels, but the conditions vary so widely that I would not be justified in saying that in no instance should a sand box be placed upon a car. I will say, however, that where it is possible to successfully operate without them sand boxes should be discarded and other means used for sanding the track. In most cases it is far more economical to fit up a special car capable of carrying a large amount of sand, and sand the track for, say 100 feet before each point where a stop is likely to be made and on grades and in places where the track is exceptionally slippery, than to sand the rail for its entire length.

REPAINTING OF CARS.

The experience of the writer has clearly demonstrated that it is satisfactory to repaint cars without removing all of the old paint. The main object in the painting of cars should be to se-

Digitized by Google

cure a hard, smooth surface which will hold out the varnish with the very smallest amount of material; the thinner this surface is the better. Care should always be taken where plaster is used to make it as thin as possible, and lead coats, color and varnish should all be carefully tempered, so as to set alike, as most cases of cracking of paint are due to the want of proper tempering of lead and color coats. A car painted in this manner should not require repainting for from six to seven years if properly cleaned and varnished.

In the selection of designs for painting of cars the plainest and neatest design should be selected as a rule. No lettering should be done on the panels, as this increases greatly the cost of maintenance in the paint shop department. In all cases the signs should be put upon signboards made especially for the purpose.

The inside of the cars should be cleaned thoroughly and rubbed down with pumice stone every second time the car comes into the paint shop to be revarnished. There are a number of so-called car cleaners on the market which are rather a detriment than an advantage to the outside surface of the cars, but which may be used to advantage on the interior of the cars, especially around the sash. Special observation of the interior of cars will show that the varnish commences to disappear first around the sash—moisture from the windows gathering around the moulding which holds the window sash, first discoloring it and gradually working into the sash itself.

As to the car roofs, the main object is to put as little material as possible on the canvas of car roofs, and that material should be elastic and yet withstand the action of the weather. Great care should be used in tempering of paints for roofs.

Unquestionably the truck of car should be painted with a good grade of lead paint, as it prevents rust, decreases renewal of bolts and adds greatly to the general appearance of the car. A handsomely painted car body mounted on a dingy, rusty-looking truck has a half-finished appearance, to say the least.

Inspection and Testing of Motors and Car Equipments by Street Railway Companies.[1]

BY FRED'K B. PERKINS.

IN discussing this subject I have decided to speak of inspection and testing separately. The work of inspection is to be attended to principally in the car houses, with a small amount of attention while cars are in service. The testing is to be done in the repair shop. In no direction can a railway company save money or increase dividends more rapidly than by having its equipments thoroughly inspected by competent men, working systematically under intelligent direction.

After a car has been through the repair shop and is again placed in service it is naturally supposed to be in first-class condition. It comes under the immediate supervision of one or more men, presumably the day and night foremen, whose duty it is to keep that car in good condition for so long a time with as little expense as is possible. These men should be thoroughly acquainted with every detail of that car. Instead of examining cars once in thirty or sixty days, a daily inspection is necessary.

In dealing with the inspection of cars in a car house containing fifty equipments we believe better results can be obtained by giving to each man some particular branch of the work, rather than assigning to him a certain number of cars and expecting him to do all the work required thereon. For instance, it is safe to assume that the controllers will be kept in better condition if the responsibility of a good repair be placed with one man only, than would be the case were this branch of the work made a part of the duties of several workmen in conjunction with all the other repairs found necessary. If this be true in regard to controllers, it will be found equally pertinent to all the other items of car inspection. There is also this advantage—the men will carry the tools and material for one particular kind of work only, whereas, if they had a multiplicity of duties to perform it would necessitate their having a large assortment of tools and material or wasting considerable time in going back and forth to the stock room.

In this modern car house five men will be required. This estimate includes only the repair men proper and not the foreman of the car house, whose duties in connection with handling of motormen and conductors, sending out cars and similar work would require so much of his time that he could only have a general knowledge of the work of inspection in the car house. Two of this number would be required to grease and inspect the motors; one to keep the controllers in repair, one to take care of the trolleys and to assist in the care of trucks and car bodies and one to have charge of the truck and car bodies.

The most vital parts of the equipments are the different parts of the motor; viz., armatures, fields, bearings, brushes and brush holders. The care of this part of the equipments should come under the head of greasing, and on the manner in which this part of the work is done depends to a large extent the frequency with which the cars will break down while in service and also the amount of repair necessary to keep them in operation.

The car should pass into the greasers' hands the first day after it is on the road and every second day thereafter. He should examine thoroughly brushes, brush holders, gears, pinions, bearings and commutator. Of these parts the care of the bearing and commutator is the most important and should therefore receive the greatest amount of attention. The manner of caring for the bearings is very simple. They must be well supplied with grease or oil and care must be taken that they are kept free from dust and grit and also that the grease feeds properly.

In the matter of the care of commutators, electricians seem divided in their opinion as to whether they should be sandpapered or not; personally, I am not in favor of it. Instead of temporizing with the commutator by sandpapering it and thereby simply putting it in shape for one more day's work, I would get at the bottom of the trouble and either make a commutator (by some preparation of mica and copper) which will not spark, or if the trouble lies deeper, remedy it by remodelling the entire motor. This may seem to be a heroic measure, but the end will justify the means.

I think, however, that usually the trouble is not in the commutator nor with the motor, but in either the brushes or brush holder, or both, and it is probable that with proper adjustment and with proper care and treatment we should find the trouble obviated and sandpapering of commutators unnecessary. When speaking of the treatment of brushes we refer to a treatment of oil or something similar.

Not later than every fourth day every controller and switch comes under the notice of the man who has charge of those parts. The main point is to clean thoroughly, using a little vaseline on the contacts. The parts that are worn should be touched up with a file or should be sandpapered, and if badly worn should be replaced, so that at least every fourth day the controllers will be sent out in first-class condition. This man can also examine the car wiring, lamp fixtures, headlights and all similar parts.

The fourth man will have the care of the trolley poles and wheels. These should be carefully looked over each night and oiled if necessary. The man who attends to this part of the equipment will also have considerable time to devote to general inspection of the car bodies and trucks under the direction of the general inspector. Under the scrutiny of these two men should come all the details of a car body, such as grab handles, window catchers, curtain fixtures and similar parts. These should be carefully attended to each day, in so much as the reputation of the road will suffer in direct proportion as the attention to these small details is neglected. For the public is exceedingly exacting as regards the manner in which its comforts are catered to in these minor details, and the degree of excellence which characterizes this part of the work will be largely instrumental in molding and fashioning its opinion of the road and of its servants in management.

After having touched upon the subject of the matter of inspection in the car house we have to deal with outside inspection: that is, inspection on the road by inspectors, motormen and conductors. It may be a good plan to have outside inspection, and it is often advantageous if not carried too far, but I do not believe it is desirable to have a large force. For this reason, that but very little of the time devoted to this line of inspection is really used in looking over the equipments, but must necessarily be consumed in getting from one car to another and in waiting for opportunities, and most of the trouble located by these inspectors is not of such a nature as to require immediate attention, and if it were the inspector could not make the necessary repairs without taking the car to the car house. Troubles of a serious nature, such as would require immediate attention

[1] Abstract of paper read before the Am. St. Ry. Assoc.

Digitized by Google

and taking the car out of service, should be easily detected by the motorman or conductor and reported at once to the proper official.

Next comes the matter of testing. The service which we will obtain from our equipments depends largely upon the manner in which the repairs are made. If the repair work be rushed through with the idea of going over as many cars as possible in a short space of time and with little or no regard for the thoroughness of the work, we must expect the necessity for repairs to increase to an alarming extent. If, on the other hand, we make our repairs with the idea that work thoroughly done will have a tendency to greatly decrease the liability to breakdowns while the cars are in service and correspondingly reduce the amount of work to be done in the repair shops, we shall naturally consider the best means not only of doing the work, but of definitely determining its condition when finished.

We must begin testing in the purchasing department. In the purchasing of supplies a great deal of trouble is often occasioned by changing the kind of material furnished. This is probably more noticeable in the case of small roads. Now, while there may be no great difference in the quality of goods furnished, or if any one of the many different brands were used exclusively, it would give satisfaction, yet the very fact that many different kinds are used has a tendency to produce a lack of carefulness in the details of the work which almost invariably shows in the general result.

When a workman once detects what seems to him to be a lack of thoroughness in any part of the work which has to do with his department you have at that moment allowed to enter that department a spirit of carelessness which will develop very rapidly, and unless quickly suppressed, will in a short time produce disastrous results.

Should we allow only one kind of material in the repair shop, the question naturally arises as to how we can avoid being behind the times in the matter of different kinds of supplies, and also in the manner of their use. The answer is, we must have an experimental room, and here must be tested samples of all supplies and materials before being contracted for by the purchasing agent. I do not mean to say that this room must be necessarily entirely separate from the repair shop, as this would naturally require a large amount of machinery which we already possess and would not care to duplicate. But this room must be considered by the employees as one in which they are not directly interested other than as they are required to work on some portion of that which is being tested, but the special testing and all the instruments for the same must be in a separate department, and if it is not possible to have a separate room, at least a part of the repair shop should be partitioned off for this work.

Having thus arranged this separate apartment for practically all testing purposes and having impressed upon employees and workmen that herein will be settled all questions relating to work done and material used, we have accomplished one of the results aimed at, in that we have prepared ourselves to impress upon the men that any material placed in their hands for use in repairs has previously been thoroughly tested, and this will, we think, tend to raise the standard of work, as any results of poor workmanship on their part cannot then be laid to faulty material, thus giving them an incentive to conscientiously deal with established and known good material.

We are now able to take anything in the line of new material or any new ideas regarding the use of the same, or any electrical problems which may arise, and ascertain their value without interfering in any way with the regular work of the shop or of the employees.

Having now provided for our testing department and established its relation to the purchasing of supplies and to the employees of the repair shop, what machines and instruments shall we need in its equipment?

A high and low-reading direct current voltmeter, one having a double scale reading from 1 to 750 and from 1 to 15. A direct current ammeter reading from 1 to 100. A low-reading ammeter would be very convenient many times, but is not absolutely necessary. A 50,000 ohm magneto bell, an alternating current voltmeter and some handy testing set will make an outfit of instruments with which we can do all the testing required.

If the alternating current is not within reach of the car house we must procure a small dynamo and produce it ourselves. A very small machine, say 2 h. p., would be sufficient for all the needs of the testing department. If this machine is designed for about 100 volts it would be most convenient for our use. With a few small transformers wound for 2,000 volts primary and for either 50 or 100 volts secondary, we are prepared to furnish any voltage within a range of from 5 volts to 10,000 volts.

The man who has this part of the work in charge can very easily and cheaply arrange the details of installation of the wiring, etc. He can also make some resistance coils and many other pieces of apparatus, which will greatly facilitate the quick testing of whatever may be sent to this department.

What shall we test? First, everything that goes into the repair shop. Second, all supplies which go to the foreman of the car houses. Third, all finished material, such as armature coils, insulation for controllers, commutators and brush holders. Fourth, all armatures, fields, commutators and controllers as they are being made or repaired.

By running a few wires from our testing room to that part of the shop where the cars are brought in for repairs, we are able to reach every part of the equipment in a quick and thorough manner, and it is probable that if a few tests are made on every car that comes to the shop many troubles will be located before they have sufficiently developed to become serious. Hence, the time required to make tests will add nothing to the pay-roll, while the benefits derived may be many. All cars should be brought to the repair shops and thoroughly overhauled and inspected at least twice a year.

In determining what shall be the standard of the work in the different branches of the shop or finished material and of cars in service, I do not believe there can be any fixed scale. But that, as we proceed with our testing and inspection, we shall gradually raise the standard of our work, and it will only be a short time after adopting a thorough method of doing the work that many of the daily perplexities will have been eliminated.

ARITHMACHINIST. By Henry Goldman, Chicago. The Office Men's Record Company. 1898. 4½x5¾ inches. 158 pages. Cardboard cover. Price $1.00.

This is the significant title of a book intended to serve as a complete self-instructor in the comparatively new science of mechanical arithmetic, and is intended to popularize the adoption of machine methods and practical accounting, which has become of great importance since the advent of mathematical machines, one of which is the arithmachine, invented by the author of the book. The book, however, besides instructing the readers as to how to use this machine, presents in an exhaustive and interesting manner the entire science of mechanical arithmetic, a hitherto untried field and a profitable substitution of physical force for mental energy. The importance of such a step is self-evident in an age in which the struggle for existence and supremacy taxes the nervous system to the utmost. The book contains besides an introductory chapter and one on the importance and utility of mechanical arithmetic a splendid historical treatise of mathematics. Then a history of computing machines and a chapter on the accountant's insight and mechanic's skill. Then follow in order chapters on machine addition, subtraction, multiplication, division, combined operations, fractions, denominate qualities, miscellaneous computations, powers and root, logarithms, correction of mistakes and speed drills. It appears as if the book would find a ready market among those who have a great deal of figuring to do in a short time and the correctness of which is of great importance.

In the Madeleine, Paris.

In the Church of the Madeleine, in Paris, a large representation of "The Last Supper," with a vision of the scene on Calvary above it, was painted by M. Paul Breham for the ceremonies of holy week. The canvas was transparent, and the colors were prepared in such a manner as to permit of illumination from the back by means of electricity, and the figures assumed a relief which otherwise would be impracticable.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1888.]

Vol. XXVI. NEW YORK, SEPTEMBER 22, 1898. No. 542.

Spare Armatures.

IN a recent issue we had occasion to comment on the troubles experienced by one or two companies operating with scant water power, and from the evidence before us pointed out the danger of overloading plants of this nature, for the reason that they do not possess the ability, like a steam plant, of sustaining a load beyond their normal capacity, while on the other hand they labor under the possible disadvantage of temporary lack of water. One of the companies thus alluded to by us takes exception in a communication appearing on another page to our comment, contending that its trouble is not so much due to unprecedented low water as it is to two machines out of three having been disabled by burnt-out armatures, which required a month to repair. The incident serves to bring out somewhat prominently the question of spare armatures and armature repairs. In the days of the eighties, when machines had not reached the proportions of those now quite common, and when the method of construction made breakdowns a frequent occurrence, it was considered prudent to have a spare armature constantly on hand. It is therefore pertinent to inquire whether the spare armature even for the largest machines is to be considered a thing of the past. It would appear that the question is one largely depending upon the construction of the armature itself. To go a step further, we should say that an armature which is so constructed that it requires a month to repair, and presumably at the factory, is not one adapted to present conditions of working. The art has advanced so far that nothing but a structural breakdown should require a factory repair, and such a breakdown ought not to occur, to begin with. Armatures will burn out at times in spite of all precautions, but a repair of this kind ought to be taken care of in the station. If it cannot be it indicates that the station is not properly equipped with repair apparatus or with competent men, or that the armature is not of such a type as to be recommended for use far from the home factory. In every well equipped power plant depending for its support on public patronage it is customary to have a spare unit, so that we may consider the spare armature to be present, but when the crucial test comes there ought to be provision for repairs such that a crippling of the service should not take place. In the case of small isolated plants in charge of less competent men, it would appear that the spare armature is going out of vogue more and more. This is due largely to the lesser liability to breakdown than formerly owing to better construction, and on the other hand to the establishment in various centres of firms devoting their sole attention to repair work. Thus, where formerly a repair required a shut-down of weeks, it can now be effected in as many days. Still, it is probable that the last word has not been said on this subject, and we would be glad to open our columns to its discussion.

Rail Bonding.

ALTHOUGH the American Street Railway Association discussed topics of importance to its members, it seemed this year to have passed over some of the minor details of railway work, which, however, go to the making or marring of the balance sheet at the end of the year. It was well, therefore, that the New York State Street Railway Association, which met at Manhattan Beach last week, took up some of these points, and among them the question of rail-bonding. For, in spite of all that has been said and written on this subject, there are many roads which still have to learn that all the rail section carrying capacity in the world is of no avail if the joint between the rails is poor or of high resistance. During the meeting above referred to a report was presented on the subject, giving in detail the work which has been done on the track of the Brooklyn Heights Railroad, showing how the old bonds had become practically useless and had to be supplemented by return feeders until these involved a considerable expense. The laying of a new track afforded the opportunity of employing a bond which has given every satisfaction and hence deserves some mention. This bond is electrically brazed to the rail. The shape of the bond depends on whether it is placed on the web of the rail, so as to come underneath the fish plate, or, as they are now applied, on the base and upper flange of the rail outside of the joint plate. All forms of the bond, however, are made up of ten or twelve leaves of 1-64 inch soft copper, the carrying portion of the bond being 1¾ inch wide and the brazed contact having an area of about 1 square inch. Soft spelter, with suitable flux, is used in brazing the copper to the steel 9-inch girder rail. The bond is divided longitudinally into three parts, so as to give great flexibility. When the rails are in position the ends of these bond leaves are interlaced and fastened together by rivets and also by solder. The length of the bond between centre of contacts is five inches and its cross section is equal to 350 c. m.

The report of the committee also refers in high terms to the Falk cast welded joint, and states that the Johnson electric welded joint promises to be equally good. All this shows that a good joint can be had, and the question then simply simmers down to whether street railway companies are willing to pay for good rail bonds. There is more than one such bond on the market and if they are not employed there can be only one reason for it.

Electricity as the Feeder of the Race.

ELECTRICITY has been hailed as the emancipator of the human race from many burdens and ills, and not without reason. Some persons, indeed, have gone so far as to predict for electricity the still greater future function of supplying the human race with the means of sustaining life itself. One of the last scientific utterances of the late Werner Siemens, in fact, was devoted to this field of electrical application. Siemens, it will be recalled, was led to believe that as the human race multiplied food would have to be supplied in a form more concentrated than offered in the present food products, as the area of the earth's surface available for food-raising purposes must in time be inadequate to the demand. Siemens pointed out at that time that electricity would undoubtedly be the medium for the production of those concentrated alimentary products. While not disputing the possibility of producing such products, it was commented at the time by some writers that the question was still open as to whether the human organism would be able to assimilate such concentrated food products. Evolution might, of course, bring about such altered anatomical conditions, but evolution was rather slow in its workings, and the race might be ex-

Digitized by Google

tinct before the concentrated product would be digestible. It might indeed be a case similar to that of the enthusiast who wanted to demonstrate that a horse could live on "excelsior." He would have proved his case had not the horse died while the experiment was going on.

Looking ahead in somewhat the same direction as Siemens did, Sir William Crookes has set the British public by the ears in a paper read before the British Association meeting at Bristol. Sir William predicts, in fact, that within thirty years the bread-eating peoples of the world will be face to face with a wheat famine of the severest kind; in 1931, when the provision made by the complete occupancy of the arable areas in the temperate zone will be insufficient to feed the bread-eating population, then swollen to 746,500,000. Where, asks Sir William, are the additional 330,000 000 bushels of wheat, which will be required ten years later, to be grown?

Unlike Siemens, Crookes does not look to the production of artificial aliments but rather to an increase in the wheat producing powers of the lands available. Starvation will be averted through the laboratory by the wholesale application of fixed nitrogen, the dominant manure of wheat. Of this there is a practically unlimited supply in the sewage of cities, now recklessly wasted, in certain soils and in the atmosphere. By means of electricity the nitrogen can be obtained in the desired form, as for example, nitrate of soda. Niagara, according to Crookes, alone could supply energy enough to produce 12,000,000 tons annually.

Wheat experts declare that Prof. Crookes has underestimated the possible wheat area of the world. But, granting that, it only postpones the limit of time when the demand will exceed the supply, so that the matter is well worthy of consideration, though not necessarily of immediate concern. Even now the artificial manure industry is of great and constantly growing importance. Our own West, including Canada, with its immense area, cannot for an indefinite period hope to harvest its present phenomenal crops without aiding the soil, any more than the worked-out Eastern farms can do so. Without the Nile to manure its fields Egypt would ages ago have become uninhabitable. Thus, in the view of Prof. Crookes, Niagara and all other available water powers may indirectly become Nile rivers in their fructifying powers. But, without calling upon the water powers necessarily, there is no question that the disposal of city sewage, now an item of sheer expense to nearly all communities, can be turned to profitable account. We are quite aware that such works require considerable area and capital for their carrying out, but once the profitable nature of the work is demonstrated, capital would be forthcoming. The outlook for electrical current application in this field alone would appear limitless.

Practical Wireless Telegraphy.

AT the time of the last international yacht race in these waters we were applied to by one of the leading city newspapers for advice as to how to follow up the boats closely and report each stage instantaneously. The idea was that electricity would be quicker than balloons, semaphores, pigeons, megaphones and other devices. We could only suggest then the running out of some special lines of submarine cable, and this was done, although with necessary limitations on the results, as it was not possible to pay out the cable and follow the competitors at the same time, with hundreds of other craft also twisting around in the vicinity of the course. Times have changed since then, and the happy declaration of another challenge from our plucky and dogged British cousins finds the Marconi wireless system all ready for practical work. It is reported that at recent races of the Royal Alfred Yacht Club, the "Dublin Mail and Evening Express" received several messages from the races from different parts of the course at different stages of the contests. That paper had hired a steam yacht, and Mr. Marconi himself set up the apparatus on board. It is stated that the messages were transmitted without a hitch and that not a single repetition was necessary. This may have been fortunate, there being no evidence of provision for repetition of blind signals or for need of fuller news.

We shall know how to advise our daily journalistic friends, if consulted again, and shall not have to refer them to vague plans suggested by this or the other inventor. But we cannot avoid wondering why our Cuban fleet did not have a try at this wireless system. The admirals soon found out that electricity was the very—the only—thing for handling the guns and ammunition in a fight, and that steam and compressed air were either insupportable or useless. They also proved the utility of searchlights. But they have not yet explained how they read each other's signals through the smoke of combat, or whether the signals were actually of much account when the hammering began. It is rumored that the electrical range-finders were not in the reckoning after the ball opened because they could not stand the concussion, and the inference is that the sensitive apparatus of wireless telegraphy might also have been crazed by a blast from the thirteen-inch guns and rendered speechless. This is one of the things to be explained. Possibly the admirals and commodores and captains read signals by intuition, and have a preference for smoke powder in case they do not wish to be able to read them. Nelson is popularly understood to have been unable to see Sir Hyde Parker's signals at Copenhagen because he put his blind eye to the spyglass. Now, where would wireless telegraphy come in?

The Westinghouse-Walker Consolidation.

THE most important consolidation since that of the Edison and Thomson-Houston interests is that just announced as having been consummated between the Westinghouse and the Walker Companies. Whether some recent patent decisions adverse to the Walker Company may have tended to hasten the welding of these two companies is a matter of conjecture, but the fact remains that under the working agreement between the Westinghouse and General Electric Companies there must of necessity be an end to litigation affecting Walker apparatus. We are glad to note that the consolidation does not carry in its train the closing down of the Walker factories, which have made an enviable reputation for their products. On the contrary, we understand that these will be kept in full activity, and, indeed, that the identity of the company will be maintained. The coalescing of these two large companies and the joining of hands of the men prominently identified with each, has given new strength to the rumor of an enormous "deal," now said to be on foot, having for its object the bringing together under one management of all the "local" electrical interests, both lighting and street railway, between and including New York and Albany. The consolidation of the Edison Company and the Kings County Company in Brooklyn is said to be one of the preliminary moves in this far-reaching transaction, which, it is said, may eventuate in the absorption also of the gas companies in the territory mentioned, and which will be handled by a company having a capital of probably $500,000,000. These are big figures and big projects; it will probably take considerable time and ability to bring about such a general merger, even if it can be acomplished at all to begin with, and we merely allude to the matter as one of the rumors of the day, suggested by a contemporary event.

When we remember that a few years ago the Walker Company started out with little capital and meagre equipment, the facts now recorded are striking. Prof. Short took up a moribund property that had chiefly been devoted to the manufacture of cable machinery, and by infusing it with his own skill and energy, was soon able to secure powerful support, so that his apparatus in enormous quantities is now found all over the country and has been heavily exported also. The patent litigation directed against the company appears to have acted, on the whole more as a stimulus than as a harassment, and the success of the Walker Company shows what can be done by energetic advertising and vigorous conduct of a business. The opportunities in the electrical field are, in reality, not a whit less than they ever were, and this rolling up of organizations with big capital only shows that there is a great deal of work that takes large sums of money to cope with it. Let us suppose for a minute that one of the big steam roads decided to change over to electricity. The New York Central, for example, has about 1,100 steam locomotives. All the electrical shops in the country could not build generators and electric locomotives to replace them in less than a period of several years, working night and day.

Digitized by Google

ELECTRIC LIGHTING.

Positive and Negative Economies in the Operation of Small Electric Light Plants.[1]—II.

BY E. P. ROBERTS.

A BICYCLIST knows the advantage of a light running, well lubricated wheel, but often that same bicyclist will vote against spending money to save power in an engine. It is sometimes said that a woman's idea of a horse power is only limited by the number of people who can get into the vehicle. There have been, in the past, men who held similar ideas as to the horse power of an engine—"as long as the horse can do it, all right"—the same as to the engine.

We now come to the engine:—In large stations it is customary to so operate that whenever an engine is in use, it is at or near its rated load or point of maximum economy of operation. Most engineers know that to run an engine on a light load is wasteful, but many do not realize that it is one of the greatest of extravagances. The losses in an engine are very nearly constant, and therefore for light loads become a very large percentage of the total. Suppose we have a 200 h. p. engine in use eight hours nightly, on a load which a 75 h. p. engine would run at a rated load. If the engines were of the same type there would be practically no difference for these sizes in the amount of steam per indicated horse power. If we take an automatic non-condensing engine, giving one indicated horse power for twenty-eight pounds steam, we would have per brake horse power:

For 200 h. p. engine at 75 i. h. p.—53 lbs. per b. h. p.
For 75 h. p. engine at 75 i. h. p.—33 lbs. per b. h. p.
Difference = 20 lbs. per b. h. p.
20 (lbs.) × 67.5 (h. p.) × 8 (hrs.) × 365 (days) = 3,942,000.

If evaporating 7 lbs. water per lb. of coal this gives 563,143 lbs. = 281.57 tons. This at $1.50 a ton = $422.35. In small stations, an evaporation of only five or six is often the average result, and the above amount would be proportionately increased. If we install a 75 h. p. engine to take this light load after the heavy load has gone off there would be no additional depreciation or repairs, because of having the additional engine, in fact the total may be less because there would be more time to adjust each engine. The engine, including foundation, would cost probably $1,000.00 to $1,300.00—extra piping and building (if necessary) possibly $700.00; call this a total of $2,000.00. The only additional fixed charges would be:

Interest on $2,000 at 6 per cent	$120.00
Depreciation on $700 at 6 per cent	42.00
A total of	$162.00

(and part of this is questionable), leaving a balance of $260.35, equal to a trifle over 16 per cent. profit, additional to the 6 per cent. already allowed, besides obtaining a more reliable plant.

In the majority of small plants, the engine, or engines, run for many hours at a very light load. Whether or not the addition of a small engine coupled to the same dynamos, or to an additional and smaller dynamo, would pay, can only be ascertained by a special examination into all the factors in each case. In one case a change was made by the advice of the writer, in the shafting arrangement, and the entire cost, including an addition to the building, was repaid in a comparatively short time. It is often said, even by engine men. "Do not get your engine too small." This is wrong; the proper advice is, "Do not get your engine cylinder too large—only large enough for the maximum work it may be called upon to do, and do not get the other parts too small." This refers to an engine for a variable load. The best proportions for a constant load are different, especially if the engine is compound, as to the ratio of the cylinder diameters. In some cases too low steam pressure is carried, and in others it would pay to condense. It is often a fact that the valve and piston leak, and that the valves are not properly set. Such losses may readily amount to 25 per cent. of the steam consumption, and not be accompanied by heating or pounding. How much can be afforded to save 20 per cent. of the steam? Practically 16 per cent. to 18 per cent. of the cost of the coal, being a little less than the 20 per cent. because some coal is used for banking and starting fires. A station burning two tons per day at $1.50 per ton, or $1,095 annually, can afford $175.20, and even if this entire amount be spent, the engine will run better and with less depreciation.

Everyone knows that a good fireman can save 25 per cent. to 50 per cent. of the coal used by a poor one, or by the good one if he is not intelligently checked. This last remark is not always added. Possibly the heating surfaces are not kept clean inside and out—a conservative estimate of loss is 5 per cent. to 15 per cent. Next that the settings are not tight—loss 2 per cent. to 5 per cent.; grates too large or too small, with fires too thin and in holes, or too thick for the draft and the coal—loss 10 per cent. to 20 per cent. Perhaps coal at $1.25 a ton is being used and evaporating less water per dollar than coal at $1.50. Possibly changes in the furnace would reverse the case and the $1.25 coal would be a positive instead of a negative economy. Often the feed water is at a lower temperature than necessary, possibly saving up to 15 per cent. Perhaps a new boiler is needed, or a larger stack. The saving to be effected and the cost can be closely approximated.

We will next consider the electrical end. Whether A. C. or D. C. be used for incandescent lighting, the great point is to deliver at constant pressure. If the consumer furnishes his lamp renewals, it may not seem to be of great importance, but from the standpoint of giving satisfaction, it is second only to reliability. The voltage at the lamps in most town plants, and in many city plants, has, I believe, a fluctuation of over 10 per cent., and in some cases of 15 per cent. A range of not over 6 per cent. is exceptional. In very few plants is the fluctuation known, and in nearly every case where ascertained by the writer, it has been a great surprise to, and hardly credited by the client. Most stations have a lamp breakage of 20 per cent. to 40 per cent. in excess of the amount readily obtainable. I have some curves on this point which may interest you. In order to improve in this particular, a study of the conditions of operation, and record of voltage at a number of places is necessary, and often a great improvement can be made at a slight expense. In one case—a plant of about 3,000 lights—we found part of the town operating at a very high voltage, "because they had to for another part of the town." 110 volt lamps were seen in use, 125 volts being noted in some cases, 100 in others. It cost about $150 to add a little wire and to take down wire in one place and put it in another and bring the whole network so that it would rise and fall together. This was a direct current plant. In an A. C. plant of about the same size, the difference of voltage between the different parts of the circuit, and the hourly variation, was still greater. In some places the lamps would not last, and no one was satisfied. It cost $100 to plan changes costing another hundred, and to save several dollars a day, and still more important, satisfaction was given. In both these cases the voltage at the station was maintained practically constant, without reference to the load, and this is a common error. Changes to produce good results can not always be made so cheaply as in these cases, but generally the distributiion can be improved and placed under control without an excessive expenditure.

If A. C. is used, it is important to have as large transformers and as few of them as practicable, often feeding into a network, at least in the business portion. This has been much discussed recently, and especialy in the paper by W. F. White, read at the Omaha meeting of the Am. Inst. E. E.

Under the head of "The Devices for Transforming Electric Energy into Light or Power," the savings to be effected are largely dependent upon the distribution. High efficiency incandescent lamps, that is, those requiring the minimum watts per c. p., can not be used if the voltage varies. The maximum difference of potential in the arc can not be maintained, nor satisfactory light given, by constant potential arc lamps on varying voltage. Motors will not govern well if the voltage drops, and would take an excessive current if forced to do the same work as at a higher voltage. For constant current arc lamps, the rated current must be maintained. Keeping the mechanism clean, not wasting carbons, and similar details of operation, are points to watch.

To ascertain the true condition of any plant, it is necessary

[1]Read before the Ohio Electric Light Association. Abstract.

Digitized by Google

that it should be carefully tested by some one having a broad knowledge of such matters. He should have, not only a training as an engineer, but also as a station man, being able to discriminate between efficiencies under special conditions (important as it is to know same), and the efficiencies which can be expected in regular run, and how far it is practicable to improve same.

In conclusion: Ascertain the facts as to the present condition of operation, make such improvements as possible by better adjustment or handling.

Make such additions as will bring 15 per cent. or more on the investment, at the same time adding to the reliability and lessening the depreciation, and as fast as the necessary money can be obtained to pay for them. Keep records and study them. Obtain and maintain a desire on the part of the employees to better the record.

Testing Arc Light Circuits.—II.

(Concluded.)

BY W. H. MARKLAND.

NOW the next question that comes up is, what does it cost to buy the necessary instruments? How much time is necessary to do the testing and recording, and can the figuring be done by a man of ordinary education.

Answering the first question, the instrument used by the writer is a Weston portable voltmeter, scale 150 volts, and a Weston multiplier, which multiplies the reading of voltmeter by 25. The highest e. m. f. that can be read is 150 multiplied by 25, or 3,750 volts, being high enough for any dynamo up to 65 lights, or enough for a multi-circuit of 125 lights. The writer tests a 125-lighter with an instrument such as the one mentioned. The multiplier 25 was picked out on account of being easy to calculate with. I believe the list price of the voltmeter and multiplier is $115, which, for interest and repairs, may add $15 per year to the annual cost of operating a station, or about a half of what you forfeit if your street circuit is out one night on account of bad grounds. The next question is, can the calculation and testing be done by the ordinary employee without injury to instruments. The answer to this is that any employee who can use ordinary care and can multiply and divide can do all the figuring necessary.

The writer has the voltmeter set in a pocket in front of the switchboard in such a manner that it can readily be taken away for other testing. The multiplier is hung up in back of the board. The voltmeter and multiplier are connected together. To the opposite posts of the voltmeter and multiplier are connected single strands of lamp cordage covered with soft rubber tubing. These cords terminate in plugs having handles somewhat like an arc jackplug; that is, a hard rubber handle having a large knob at the top to prevent accidental contact of hands with the brass part. This portion is made of wire about ⅛" in diameter, bent in the form of a hook, which is so made that it can be readily hooked over the brass parts of arc jackplugs.

In testing the e. m. f. of a circuit the voltmeter handles are hung on the jack terminals of the circuit, one on the positive and one on the negative, and the volts shown on voltmeter as well as the circuit number are recorded. This should be done on each circuit. Time taken per circuit, about 15 seconds.

In testing for grounds one voltmeter terminal is connected to say the positive terminal of the circuit and the other voltmeter terminal to the ground, and volts are read. Then the opposite voltmeter terminal is connected to the negative side of the circuit and the other voltmeter terminal to ground and recorded. Where there are several circuits on one dynamo they should all be treated as though they were one circuit; that is, the voltmeter terminals should be connected to wires leading from the positive and negative terminals of the dynamo. In testing for grounds on a multi-circuit dynamo each division of the dynamo should be treated as a separate dynamo and duly recorded. In the event of a ground showing up in a test where there are several circuits connected to one dynamo or a ground on a multi-circuit dynamo, it is advisable to run the circuit the ground appears to be on on a dynamo by itself, as ground can be located with much more accuracy.

In testing the greatest e. m. f. a dynamo will generate after repairs have been made or for record, simply hang voltmeter terminals on positive and negative terminals and read results.

In testing for leaks or escapes from wires of dynamo to frame, disconnect the dynamo from the switch, take out brushes, run a wire from one side of a circuit that is in operation, which need not be of over 10 lamps to frame of dynamo to be tested, connect other side of circuit to one voltmeter terminal such as is used on the switchboard, run a wire from the other voltmeter terminal to the dynamo and connect for an instant to wire of armature and then to fields. If the voltmeter shows an e. m. f. equal to that of the circuit from which current is taken, localize the fault by disconnecting the fields from each other, or if possible, the bobbins of armature and test each out separately. The e. m. f. of the circuit from which current is taken, as well as the e. m. f. of each test should be carefully recorded and result figured as explained later. If the insulation resistance is below 100,000 ohms, look for burn-outs. In case of foreign current on circuits, connect one voltmeter terminal to circuit when you have the circuit disconnected from dynamo, and connect the other voltmeter terminal to the ground. The voltmeter will show if it be 110-volt lighting, 500-volt trolley circuit, or arc circuit by the volts indicated. If an arc circuit is shown up connect the voltmeter terminals to each arc loop in succession, and when the voltmeter shows reading you know the two circuits are crossed. In the latter case the test can be made when current is on all loops. For accurate locating of trouble one circuit should be disconnected and the idle circuit treated as though it was a ground wire and location of fault figured out, as will be explained later.

As can readily be seen, all the above testing can be done by the engineer or dynamo tender, who does not require any particular training. All that is necessary is to record properly the volts shown by the voltmeter and see that the right voltmeter terminal is put on the right pole of the circuit. The multiplying and dividing can be done the next day by the superintendent or clerk.

Now to figure out and record what the engineer or dynamo tender has put down in a shape that will be of use. To do this the writer uses a slide rule. This, to one who does not know how to handle it, is a great mystery, but any person can in two weeks find out all that is necessary about it. With the slide rule the operation of figuring out the e. m. f. of lamps on a circuit is as follows: Take number of lamps in circuit and add one lamp for each two miles of No. 6 wire. Set this number on slide over the ratio of the multiplier (say it be 25) on rule, and under the number on slide agreeing with volts read on voltmeter will be found volts per lamp. Set this down in your record, giving date, time of day, circuit number and state of weather. Time taken per circuit, 15 seconds.

If slide rule is not used multiply volts read by ratio of multiplier and divide by number of lamps. If the results show low adjust lamps higher; if too high, adjust lamps lower. If high one time and low another, look for lamps drawing long arcs or lamps that go out and start up again. By comparing records from day to day the variations can be noticed.

To figure grounds or escapes, for all practical purposes the following plan answers all right, although more elaborate ways have been propounded in text-books. Add together volts read on voltmeter when testing to ground (never mind multiplier) on positive and negative side of circuit, set this on slide over number of volts read on voltmeter when testing from positive and negative side, subtract one from number read under index, set index on last number, and under number agreeing with resistance of voltmeter and multiplier will be found the resistance of ground. Time taken, 20 seconds. Without slide rule the formula is $R = R^1 \left(\frac{\text{e. m. f. of dynamo}}{\text{e. m. f. of grounds}}\right) - 1$, or divide e. m. f. of dynamo by e. m. f. of grounds, subtract one from the quotient and multiply by the resistance of the voltmeter and multiplier, giving ohms to ground.

In recording the same simply set down the fractions of a megohm. That is, if the resistance was 146,000 ohms, simply set down .14, which is close enough for ordinary lines.

A fairly well insulated aerial line will show escapes to ground under most conditions of weather. The higher the e. m. f. of the dynamo, the lower will be the insulation resistance. In wet weather the insulation resistance will be very low. But a fairly well insulated line will in wet weather show about the same number of volts escape or resistance to ground on each pole of circuit. This need not cause unnecessary alarm, and, as a general thing, is hard to prevent. In the event, however, of one pole of the dynamo showing a low resistance to ground and the other a high, then look for trouble, or in the event of one circuit drop-

Digitized by Google

ping low in insulation resistance while the others show high under the same conditions of weather and surroundings, also look for trouble. Now, suppose the circuits were duly tested and recorded by the proper person. The superintendent looking over the record the next morning can quickly note any deviation from the normal condition of circuits. If one circuit shows a low insulation resistance, say when the dynamo is generating 60 volts (read on voltmeter, not taking multiplier into consideration), the positive side to ground reads 40 volts and the negative 20 volts; this would show a dead ground, which will be found located somewhere close to one-third of the lamps from the negative side of circuit. That is, if it was a 30-lamp circuit the trouble would be near the tenth lamp from the negative side. In the event of the voltmeter reading less, say 15 and 30, it would show an escape that should be investigated, and it will generally be found to be the result of dirty insulators or bad lamp hangers, and, as we all know these badly insulated spots do not grow better by neglect. Of course, we cannot always expect a two to one proportion, but by a division of lamps on the circuit the trouble can be located nine times out of ten, always remembering that the pole of the circuit showing the least volts to ground is the one nearest to where the escape is located.

LETTERS TO THE EDITOR

Yellow Journalism and Society Badges.

In the "New York Journal," evening edition of September 15 and morning edition of September 16, is given what purports to be a list of members of the American Institute of Electrical Engineers to whom were furnished the society pin of the so-called "kite design," which was abandoned in 1897.

One of these badges was found on the clothing of a woman killed on Staten Island. As I refused to supply any reporter with a list of members owning these pins, I deem it proper to inform you that out of the twenty names printed in the "Journal," only seven were owners of the style of pins referred to. The names were simply taken promiscuously from our catalogue of 1,100 members.

As only 264 of these originally possessed the pins, and 32 have since been returned, the impossibility of any person compiling a correct list without access to the books of this office is apparent.

RALPH W. POPE,
Secretary American Institute of Electrical Engineers.

New York City, Sept. 16, 1898.

Water Supply for Power in California.

IN your issue of September 1, in an editorial headed "The Limitations of Power Transmission," you make the statement that our company has been unable to furnish the city of Riverside with the 200 h. p. to be delivered under our contract, and that this trouble is due to lack of water in the mountains.

We are surprised that you should make so unequivocal a statement without communicating with us and hearing both sides of the case, as such a statement made in a publication of such high standing as The Electrical Engineer might cause us serious loss of reputation and possibly financial damage.

The facts in the case are these: We are now under contract to deliver from our power house about 700 h. p. continuously, and among our customers is the city of Riverside, to which we contract to deliver 200 h. p. We have three 250-kilowatt generators installed at our power house, and as a consequence of heavy thunderstorms the armatures of two machines were burned out at the same time, so that we were only able to operate one machine during the time of repairs, which extended over about four weeks. On this account we were compelled to cut down the delivery of power to all of our customers, and the city of Riverside suffered with the rest. While the flow of water in all the streams in California has been extraordinarily low this season owing to the fact of an abnormally light rainfall, yet had it not been for the accident which deprived us of the use of our generators there would have been no difficulty on our part in maintaining our contracts. To prevent the repetition of such an occurrence in the future, we immediately ordered an extra armature to be kept on hand.

The rainfall in this portion of the State of California has during the season of 1897-1898 been less than 30 per cent. of the average rainfall for the past twenty-seven years, and the present season is the third dry season which we have had in succession.

We trust that you will through your columns do us the justice of publishing this statement.

REDLANDS ELECTRIC LIGHT AND POWER CO.,
By H. H. Sinclair, General Manager.

Redlands, Cal., September 10, 1898.

Automatic Motor Starting Boxes.

The Cutler-Hammer Manufacturing Company, of this city, mailed a circular letter to the trade under date of August 17, 1898, stating that a certain Chicago manufacturing company was about to enter the market and infringe their patent No. 418,678, issued January 7, 1890, and patent No. 368,804, issued August 23, 1887, making an instrument an exact duplicate of that manufactured by them.

The Cutler-Hammer Manufacturing Company informed us to-day, and we beg to state that this letter was not directed against us, but against a concern with which the Cutler-Hammer people have been having trouble and against whom they are about to commence a lawsuit.

We beg to state that we have acquired a legal right to the use of Patent No. 577,036, issued to Mr. Charles D. Jenney, on February 14, 1897, for electrical switch as applied to automatic motor starting box. This Jenney patent has been held by the United States Court in Indiana, in a case heard on October 29, 1897, brought by the Cutler-Hammer Manufacturing Company, to be valid and not to infringe the Cutler-Hammer rights in any way. Our customers, therefore, run absolutely no risk in handling any of our goods. Our patents are all valid. We have the legal right to the use of patent No. 577,036, and all of our other patents belong to us and are fundamental.

RASTER CARBON RHEOSTAT COMPANY.

Chicago, September 14, 1898.

TELEPHONY AND TELEGRAPHY

A Farmers' Cooperative Telephone System Around Mansfield, O.

BY HARRY T. MANNER.

THE Farmers' Co-operative Telephone Company, of Mansfield, O., are organized for the purpose of connecting up the farmers in some nine or ten counties in that section of Ohio and building toll lines and establishing exchanges, and to do other business connected with telephony. We have a system of building lines that we think cannot be excelled. We have $1,000 of our capital stock sold and do not desire to sell any more except as hereafter explained. We give any man that raises a certain line a share of stock in the company fully paid up. The party raising the line is required to sell easements and tickets to build the line with our local bridged line to connect the farmers and a metallic toll line. An easement sold to a farmer gives him one free connection with the local bridged line and the free use of the same but not of the toll lines. It costs a farmer desiring an easement right from $30 to $50, depending upon the locality in which he resides and the cost per mile. The cost generally runs from $40 to $50 per mile, with the local bridged line and a full metallic toll line. We use all long distance telephones of the most improved make of the bridged system. Our company is composed of the best citizens of the county. We expect to place an exchange in every town of any size in the several counties in which we operate. Our toll rates are low, only being 10 cents for a five minutes' message. Our coupon toll tickets are put up in booklets of 100 each, which we sell for $8.00 at a discount of 20 per cent. to aid us in building lines, each coupon good for one message.

We now reach the following towns on our circuit: Bellville,

Digitized by Google

Butler, Newville, Perrysville, Davis P. O., McKay, Londonville, Hayesville, Widowville and Mohicanville, O., besides other towns by connection with other independent companies. We are extending our lines from Butler, O., to Ankenytown, O., when we will connect with the Mt. Vernon (O.) Telephone Company, which will give us a great field to operate in. We are placing our poles at thirty to the mile and are doing first-class construction. We have on our lines and connections which we have free access to nearly one hundred farmers. All are well pleased with it and the farmers are becoming alive to the use of the telephone.

The officers of the Farmers' Company are W. A. Wallace, president, and N. C. Manner, secretary. The total capital stock is $10,000. The Stromberg-Carlson, Keystone and Crescent Ideal apparatus is used.

POWER TRANSMISSION

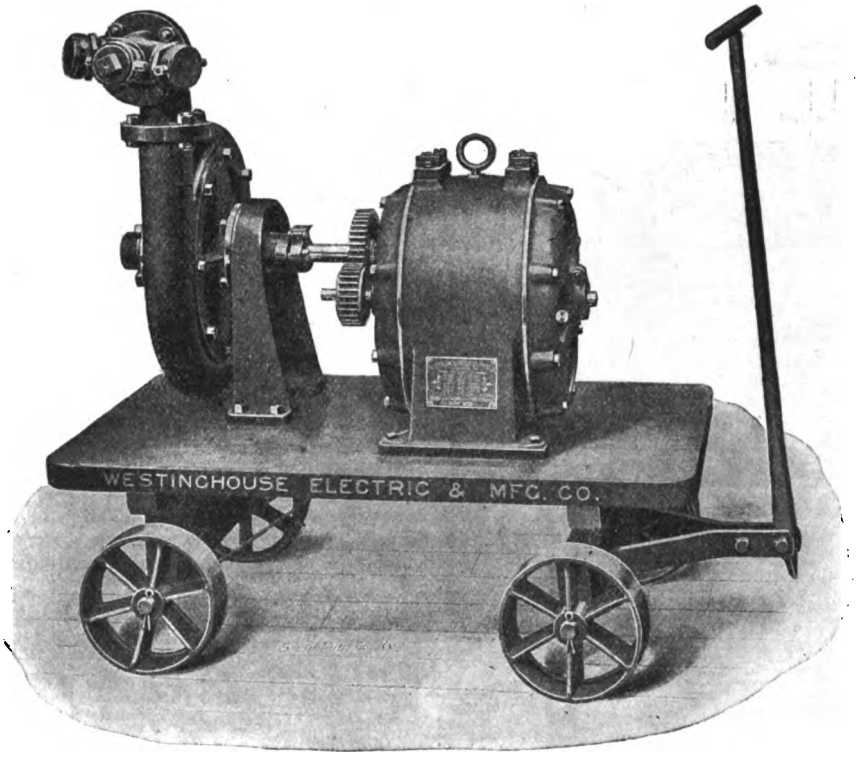
Portable Electric Pump Outfit in a California Winery.

THE varied applications of electrical power are no more strikingly illustrated than in the subject of portable electric pumps. While the combination described below has been especially designed to be used in the California Winery, of Sacramento, Cal., it is one that may be applied to various other purposes.

The outfit consists of a Westinghouse Electric & Manufacturing Company's type "C" alternating current induction motor of 2 h. p. capacity direct connected to a centrifugal pump. The machines are mounted upon a suitable truck, by which they are transferred from place to place in the operation of pumping wine from one vat to another. Receptacles for electrical connections are provided at convenient points throughout the winery, and the motor is connected by means of flexible cable to the circuit of the Central California Electric Co., whose power is generated at Newcastle, 30 miles distant from Sacramento.

The simplicity of both pump and motor renders them ideal in construction. The motor has neither commutator nor brushes, and there is no connection between the revolving part and the electric circuit. Beyond the occasional oiling of the bearings, no further attention is required over long periods of operation, and it may be handled by the most inexperienced persons with perfect safety.

The centrifugal pump is peculiarly adapted to handle liquids of whatever nature. It is capable of pumping under the most difficult conditions, and will handle hot or cold liquids successfully, even though they contain from 20 to 40 per cent. of solids. Thus it will be seen that the applicability of the device extends beyond the luxuries of life, as in the pumping of wine, beer or other spirits, to the more arduous duty of pumping the dirty and muddy accumulations in electric subway manholes, tannery liquids, dyes, bleaching solutions, vinegar and brine liquids used in pickling, and, in fact, is applicable to a multitude of services in the arts and manufactures in which it is destined to be a permanent economic feature.



PORTABLE ELECTRIC PUMP OUTFIT IN A CALIFORNIA WINERY.

ROENTGEN RAYS

The Edison Portable Cabinet X-Ray Outfit.

AT the beginning of the Santiago campaign the necessity of equipping the hospital ships with efficient and powerful X-ray apparatus was immediately perceived by the Surgeon General of the United States Navy, who realized the importance of installing apparatus which should be the most powerful of its kind and also which should be so simple in construction and operation that it could be properly handled by any ordinary mechanic. An order was, therefore, placed with the Edison Manufacturing Company for one of their latest portable cabinet X-ray outfits, to be placed on board the U. S. naval hospital ship Solace, and the entire apparatus was placed in position ready for use within forty-eight hours after the placing of the order. A brief description of this apparatus, which is illustrated herewith, may be of interest.

Digitized by Google

The cabinet, which is made of polished quartered oak, of massive construction, occupies a floor space of 2 feet 8 inches by 1 foot 8 inches, and is furnished with four wrought-iron L's screwed onto the base, by which it can be rigidly fastened to the deck. This is most necessary, as, in case of heavy weather, the apparatus might be damaged by the ship rolling if it were not firmly attached in this way.

The Edison coil, which is mounted on top of the cabinet, is also furnished with brass L's and strips to hold it firmly in position, and the base of the adjustable focus tube stand is similarly screwed to the top of the cabinet. The upright part of the focus tube stand has a wooden screw at the end of same, by which it is attached to the base, and when the focus tube stand is not required to be used it is only necessary to unscrew the upright from the base, which can be done in a moment.

The distinctive feature of the Edison electric light X-ray outfits is that there is no vibrator on the induction coil, its place being taken by the instantaneous air brake wheel device shown in the bottom part of the cabinet.

This device consists of two tooth-wheels mounted on the same shaft. The projections or teeth make contact with two flat brushes, which bear on the outer peripheries, and by which the current is brought in and led out again. These wheels are rotated at a very high speed by a small direct current motor, which also runs a pressure blower. The air blast from this blower enters a bifurcated tube and is connected to two flat nozzles immediately over the contact brushes.

When the device is set in operation, by starting the motor and connecting the primary of the Edison X-ray coil in series with the binding posts (attached to the break-wheel), provided for this purpose, the spark formed at the contact brushes, when the coil is energized, is instantaneously blown out by the air blast at the moment of formation. This greatly increases the rapidity of the rise of electromotive force in the secondary coil.

The controlling rheostat shown on the upper shelf of the cabinet is used to vary the current in the primary of the Edison coil, and the lever arm of the rheostat is connected to the extension

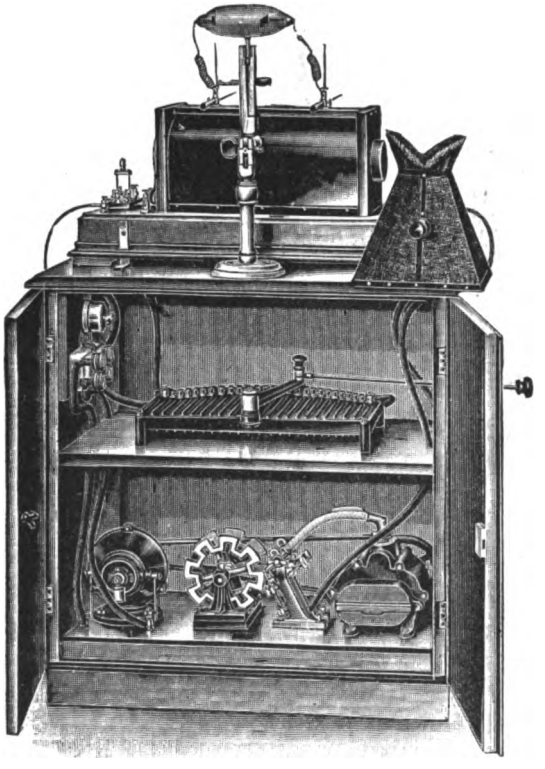


FIG. 1.—EDISON PORTABLE CABINET X-RAY OUTFIT.

rod, passing through the side of the cabinet so that the doors of the cabinet can be closed and the rheostat actuated by means of this extension rod, which is shown on the right-hand side of cut. The main switch is shown on the left-hand side of cabinet, near the top, and the cut-outs directly underneath same. The advantage of this arrangement is seen at a glance, as the keys of the cabinet are always in the possession of the chief surgeon on board ship, and it is impossible for any one to use the apparatus without his permission.

The coil is protected by a polished oak cover (not shown in the cut), which fits over the top of the cabinet, and in which room is left for the fluoroscope to fit into, so that the apparatus is entirely protected when not in use. The operation of the apparatus is exceedingly simple. The focus tube is clamped in the jaws of the focus tube stand and connected to the secondary binding posts of the Edison coil by two highly insulated thin wires.

The doors of the cabinet are now opened and the main switch

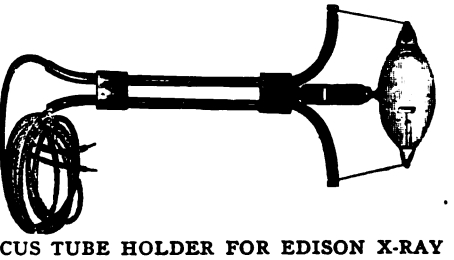


FIG 2.—FOCUS TUBE HOLDER FOR EDISON X-RAY OUTFIT.

is turned, which starts the motor and the pressure blower in operation. The doors of the cabinet are now shut, in order to economize space, and the reversing switch shown on the left of the coil is closed, so that the secondary current from the coil excites the focus tube, and the energy of the coil is increased by gradually drawing out the extension rod attached to the lever of the controlling rheostat.

The patient is now placed in front of the focus tube and the fluoroscope placed behind the limb or that portion of the trunk that it is desired to examine. In cases where the patient is so seriously wounded that it is necessary for him to maintain a reclining position, the focus tube is attached to the portable focus tube holder, as shown in Fig. 2, and the focus tube stand is dispensed with. The ends of the portable tube holder wires, which are very highly insulated, are now attached to the secondary binding posts of the coil. These heavily insulated connecting wires are several feet in length and the portable focus tube holder is made of hard rubber, so that it can be handled easily without fear of shock to the operator. The portable focus tube holder with focus tube is now placed underneath the cot or operating table and the surgeon makes his examination by looking through the patient from above.

The entire apparatus is substantially and strongly made, and is also of handsome design, and the work that has already been done with it has shown the great value of such an apparatus in warfare and the necessity of equipping all naval, marine and military hospitals with a device of this kind.

One great advantage possessed by this apparatus is that it can be moved from place to place without delay, as the cabinet is mounted on heavy casters, and it is only necessary to disconnect the attachment plug and cord attached to the main switch from the receptacle into which it may be screwed, and the cabinet may then be moved to any part of the ship or hospital and attached to another receptacle by screwing in the attachment plug, which will not occupy any time whatever. We understand that the Edison Manufacturing Company have one of these cabinets in operation at their show rooms, St. James Building, Broadway and Twenty-sixth street, New York.

PERSONAL

CAPT. SAMUEL TROTT, of the cable steamer Minia, returned recently to England invalided and may be on sick leave for some months at his home in Devon. His last repair work was on the Anglo-American 1894 cable in 2,440 fathoms. The fault was cut out with remarkable quickness, interrupting the working of the cable only four and a half days. Capt. Trott's hosts of friends on this side of the Atlantic will wish him a speedy recovery of full health and strength.

PROF. R. B. OWENS passed through New York last week on his way from Baltimore to Montreal, where he is to occupy the chair of electrical engineering at McGill University, where abundant opportunities for good work await him and where his

Digitized by Google

long experience at the University of Nebraska should prove very valuable.

EDUCATIONAL

The Correct Theory and Method of Organization and Conduct of Professional Schools.[1]

BY PROF. R. H. THURSTON.

THE Correct Theory and Method of Organization and Conduct of Professional Schools, generally; the special methods applicable to (a) Professional Schools of Engineering; (b) to Trade Schools; (c) to Manual-Training Schools; (d) to mixed Professional and Educational Curricula.

The sub-topics under this subject are:

1. In the technical high-school, what properly determines the form and extent of its technical and other courses?

2. In such schools, what should be the extent and character of what may be termed the distinctive and essential entrance requirements? What the non-essential requirements?

3. In the technical college, what should be the nature and extent of these two different classes of demands? What courses should be offered in response to the demand for technical instruction from people whose sons must go directly into business from the lower schools if they cannot obtain a directly useful technical training?

4. The professional engineering school, now being evolved—the distinctly professional school, having the same position and purpose as, in other professions, the law and medical schools—must soon, if not at once, require definition and delimination from the academic colleges. What should be the entrance requirements?

(It is understood, of course, that what is practical is limited by the practicability of the existing schools providing it, and that what is desirable is determined by the demands of the profession relating to distinctively professional courses.)

5. To what extent should the existing views and traditions of the people generally, and the prejudices of the academic teachers and monastic scholars, be deferred to, in the construction of the curriculum of the professional school of engineering, in which, as must be assumed, the work is to be professional training and not, in the accepted sense of that word, education?

6. If, as is the fact in the State of New York, a body of academicians—its Board of Regents—assumes to control and to dictate to the faculties of the professional schools, what course should be taken to secure independence from such inexpert direction and to insure the management of professional institutions by professionally expert faculties?

7. Assuming that it is obvious and is admitted that the form and extent of a professional course must be simply that which is demanded by the character of the work of that profession, and that it may be taken for granted that students entering such institutions will, as a rule, if not invariably, have sufficient intelligence and judgment to secure just as much of liberal education, of real education, in the accepted sense, as possible—what should be the length, the extent, and the limitations of such courses in the distinctively professional school?

8. In such institutions, what other than professional work, if any, should be offered? What entrance requirements would suffice? Should the policy be that of a wide range of non-essential entrance requirements and high academic culture, with, necessarily, few students; or should the entrance requirements be restricted to characteristic and essential introductory work? With, presumably, unobstructed freedom of entrance of all classes and conditions of men; provided only that the poorest of them has obtained competence in preparation in the essential requirements for entrance upon professional studies as taken up at the beginning?

9. In the technical high-school, and in the technical college, of the more common sort in this country, in which some educational work is often necessarily offered, where should the lines be drawn in respect to entrance requirements, and, in constructing the courses themselves, in such semi-professional schools?

10. What are the similar conclusions respecting trade-schools and what respecting the manual-training schools now becoming common in our cities?

11. How shall we classify all these various, as yet undefined, courses and schools, in order to secure some definite principle of organization and operation?

[1]Abstract of paper read at the sixth annual meeting of the Society for the Promotion of Engineering Education, Boston, Mass., August, 1898.

SOCIETY & CLUB NOTES

Manhattan Beach Meeting of New York State Street Railway Association.

THE sixteenth annual convention of the above association was held at the Manhattan Beach Hotel, Sept. 13 and 14, the weather both days being almost perfect.

It is gratifying to note that this is decidedly a growing institution, not only as to number, but in interest and importance. This, the sixteenth annual meeting, will be memorable as the largest and most important of all, not only from the large number of members in attendance, which included delegates from nearly all of the principal systems in the State, but also representative street railway men from other States, who found it convenient to take in New York on their return from the Boston convention, and so meet their fellow craftsmen again down by the sea. For this reason, and because of the unusual number of supply men present, the attendance reached more than 150.

The gathering was unique, in that it included the representative head of the great Metropolitan system of New York, and the heads of the two principal street railway systems of Brooklyn, and also that of Buffalo, N. Y. These representatives sat in the meeting listening and taking part in the discussion, on the same plane with some of their own subordinates and with representatives from the street railway systems of small towns or delegates of some cross-country roads. So important is this association, not only in its convention work, but in the work done by its sub-committees all during the year, in looking after the street railway interests of the State at Albany, and wherever these interests are at stake, that no street railway company in the State having its own well-being at heart, can afford to remain without a representation in its deliberations.

The ruling spirit of the association, and the one to whom the new life of the institution is chiefly due, is the president, who was re-elected to the office for the third or fourth time. One of the secrets of the success of the meeting was the fact that a printed programme had been prepared, on which the hour and minute of successive meetings and entertainments were noted, as well as an order of business, and this was closely followed. Both of the sessions on Tuesday and the morning session of Wednesday were well attended, and the papers read were all of special interest, and all were followed by a free discussion which emphasized the principal points and gave each delegate an opportunity to state the results of his own experience. An interesting feature of the final meeting was a short address by Mr. K. Sugahavra, a Japanese gentleman representing one of the tramway companies of that country.

The entertainments provided by the local committee were all in good taste and were very enjoyable. These included, first, a special display of Paine's fireworks, "The Fall of Manila," from the amphitheatre provided for this purpose at the island. This entertainment was followed by the annual banquet, the tables being laid in one of the large dining rooms of the hotel, and to which about 125 guests did ample justice, the menu being followed by the usual speech-making and story-telling. The final entertainment, which was inaugurated at 11 o'clock on Wednesday, including a ride from the Beach through Flatbush and parts of Brooklyn in five parlor cars, which were provided by the two principal Brooklyn companies. On the route a halt was made at the Brooklyn Navy Yard, through which a trip was made on foot, including a visit to the five or six battleships recently returned from the Santiago campaign, among which the Oregon and Iowa were of special interest, as they were being fitted out for a cruise to the Philippine Islands. On leav-

Digitized by Google

ing the Navy Yard all were conveyed by the cars to the dock beneath the Brooklyn Bridge, where the little steamer Hudson was in waiting, and on which a sail was made up the East River, past the public institutions on the islands, to Hell Gate, then into the Harlem River through the numerous draw bridges which connect the island with the main land, including the new Third avenue bridge, just opened, and the new draw of the New York Central Railway. Then it continued on to Kingsbridge through the Government canal and Spuyten Duyvil Creek into the Hudson, then down past the Palisades and Grant's Monument to the Battery, a stop being made at 130th street for those who desired to disembark there. Luncheon was served on the steamer, and every attention was given by the local committee to help everybody to have a good time, and every one was profuse in praise of those having the entertainments in charge. Before landing three cheers were given for the principals by name, and also for the new, old president of the association.

The business done by the convention included the reading of papers and reports of various kinds. Mr. H. M. Kennedy read a paper on "Methods of Developing New Traffic on Street Railways," which brought out a long and interesting talk on amusements, by Messrs. Vreeland, Johnson, Cooper, Ely, Cole, Wyman, Clark and others. A paper on "Signal Service for Single Track Roads" was read by Mr. H. S. Cooper, of Schenectady, and discussed by Messrs. Powers, Rossiter, Johnson, Clark and Ely. A very interesting paper on the "Utilization of Exhaust Steam from the Power House" was read by Dr. M. M. Fenner, of Dunkirk, N. Y., giving the record of four years' successful experience. It was discussed by Prof. R. C. Carpenter and others. The question came up of charter rights to do this class of business.

Invitations were received to hold the next meeting at Ithaca, Fredonia and Buffalo.

A paper on "Track Bonding" was presented by Mr. R. P. Brown, of Brooklyn. Mr. W. J. Clark read a paper on "Electric Railways as an Auxiliary to Coast Defence." A paper was read from Mr. Moxham on "The Construction of Rails from a Scientific standpoint." Mr. D. F. Carver, of the Brooklyn Heights Railroad, read a paper on "Track Construction." Messrs. Littell and Vreeland gave some favorable data on "Storage Batteries for Railway Power Plants." Mr. T. J. Little, Jr., read a paper on "The Relations Between the People and the Street Railways." Mr. T. J. Nicoll, of Rochester, presented a report on "Individual Fare Boxes."

The election for 1898-9 resulted as follows: President, G. Tracy Rogers; first vice-president, W. Caryl Ely; second vice-president, A. L. Johnson; secretary and treasurer, H. A. Robinson. It was voted to hold the next meeting at Ithaca.

A representative from each of the following papers was in attendance: "Street Railway Journal," "Street Railway Review," The Electrical Engineer, "Electrical World," "Electrical Age."

EXHIBITS.

One of the large halls of the hotel was set apart for the exhibition of such appliances and machinery as were to be placed on exhibition, and the exhibitors numbered about twenty. To these the delegates gave careful inspection which, of course, was gratifying to those in charge. Although the number of exhibitors was not large, there were quite a number of supply men present, not only from New York, but from other States.

Among the exhibitors, the following firms were represented:

COMPOSITE BRAKE SHOE CO., 620 Atlantic avenue, Boston, Mass. Exhibit consisted of specimens of their cast iron shoe with cork insets known as the "Compo." Mr. William W. Whitcomb, manager of the company, conducted the exhibit.

CAMPBELL TRACTION CO., Towanda, Pa., exhibited a model of a three rail system, the principal features of which are a bicycle trolley running within a conduit, being propelled by a magnet on the car and so arranged as to lead the current from the feeder or lower conductor into the sectional covers of the conduit. Mr. George L. Campbell, inventor, was in charge of the exhibit.

FALK MFG. CO., Milwaukee, Wis., exhibited an auto-motorneer, a device to be attached to a controller to save current, which was designed by G. W. Knox, electrician, Chicago City Railway Co. Mr. Samuel B. George, general agent of the company, explained the merits of the device to the visitors.

BIBBER-WHITE CO., Boston, Mass., exhibited a full line of overhead material, headlights and lamp socket.

J. P. SJORBERG & CO., New York, exhibited specimen of street car woodwork, W. J. Walker being the representative.

HALE & KILBURN MFG. CO., New York and Philadelphia, exhibited a line of car seats, the exhibit being in charge of Mr. A. F. Old and F. H. Newcomb.

WILSON, THOMSON & CO., 313 Fulton street, Brooklyn, N. Y., exhibited a trolley pole catcher, W. J. Thompson being in charge.

GEORGE A. PARMETER, Cambridgeport, Mass., exhibited car fender, automatic wheel guard and track scraper.

CUTTER ELECTRIC & MFG. CO., Philadelphia, Pa., exhibited a fine line of circuit breakers.

SAFETY THIRD RAIL ELECTRIC CO., Temple Court, N. Y., exhibited a model of their third rail system with new section railway switch.

F. H. NEWCOMB, Brooklyn, N. Y., exhibited a full line of uniform caps.

AMERICAN VITRIFIED CONDUIT CO., 20 Broad street, New York City, showed samples of single and multiple duct, vitrified glazed conduits.

ROOKE REGISTER CO., Peoria, Ill., exhibited the Rooke Fare Register, the same being presented by George F. Rooke, A. M. Soper and A. W. Jamison.

W. T. VAN DORN CO., Chicago, Ill., exhibited drawings of the rigid drawbar designed for both electric and steam traffic. Mr. Van Dorn was present to explain the merits of the drawbar.

WILLIAM PRESTON, 859 Fulton street, Brooklyn, mechanical track switch or turnout which is designed to be operated by the motorman by pressing a foot lever on the car. This switch differs materially, however, from all previous efforts in this line.

NEW HAVEN CAR REGISTER CO., New Haven, Conn. A fine line of single, double and triple registers. Some of the special features of these machines are that they totalize separately and that arrows show the character of the last fare rung up. Represented by Willis M. Anthony and A. W. Chappell.

Nineteenth Convention of the Association of Edison Illuminating Companies.

THE Nineteenth Convention of the Association of Edison Illuminating Companies was held at Hotel Iroquois, Sault Ste. Marie, September 12. There was a large attendance and the convention was a success, both in respect of work done and in its social features.

The first meeting was opened promptly at 9 a. m., Monday September 12, by President Insull. There was no formal presidential address. After roll call the Edison Companies of Detroit, Chicago, Brooklyn, New York and Boston, stated by their representatives their experience during the past year and their present practice in making rates for supply, especially low rates for long-hour use, and with particular reference to the Wright and the two-rate method of charging. The statements showed great diversities in methods but invariable good results following readjustment in favor of long-hour consumers. The discussion was general and was by consent reopened the next day. Monday evening at 7:30 Mr. W. S. Barstow described the Brooklyn transmission system in detail. He was followed by Mr. J. W. Lieb, Jr., who reported what the engineering commission recently sent to Europe by the Edison Electric Iluminating Company of New York, consisting of Mr. Lieb, Mr. John Van Vleck, its constructing engineer, and Mr. Arthur Williams, saw there of electrical and mechanical interest. The following discussion was opened by Mr. Herbert A. Wagner, of St. Louis, and had reference largely to alternating current practice.

On Tuesday morning Mr. Arthur Williams spoke of European practice in meters and charging systems, lamps, fixtures and details, as observed by the New York company's commission. His talk was followed by three papers on meters and metering, by Mr. E. A. Leslie and Mr. Charles S. Shepard, of New York, and Mr. Oliver J. Bushnell, of Chicago. These were replied to by Mr. Caryl D. Haskins, of the General Electric Company, and discussed very fully by Messrs. Scovil (Cleveland), Huntington (Spokane), Chandler (Sault Ste. Marie), Barstow (Brooklyn), and Ferguson (Chicago). A special afternoon session was found necessary, at which the discussion of meters and metering was continued; two papers read by Mr. C. C. Perry, of Indianapolis, and Mr. W. F. Kingan, of Sault Ste. Marie, on the problems of

Digitized by Google

smaller stations, and a very full report presented by Mr. Chandler from the association's committee on Welsbach burners and acetylene gas (Messrs. Stetson, Chandler and Leslie).

The last session, held Tuesday evening, received and considered the reports of the executive committee, the committee on incandescent lamps and the lamp testing bureau. The final business was the election of officers for the ensuing year, who are as follows:

President, R. R. Bowker, New York; vice-president, G. R. Stetson, New Bedford, Mass.; treasurer, W. S. Barstow, Brooklyn; secretary, Wilson S. Howell, Newark, N. J. (P. O. Box 114); executive committee, Samuel Insull, Chicago; Charles L. Edgar, Boston, Mass.; J. W. Lieb, Jr., New York; Alex. Dow, Detroit; J. H. Vail, Philadelphia.

The greater part of the attendants at the convention arrived at Sault Ste. Marie by steamer Northwest Sunday evening and returned by the same steamer, leaving Wednesday afternoon. The lake trip was highly enjoyed and was one of the most pleasant features of the Convention of 1898, especially as it afforded opportunity for a good deal of interchange of opinions and experiences. At Mackinaw Island, on the upward trip, the delegates and ladies of the party were entertained by a carriage ride to points of interest, the invitation being tendered by the General Electric Company. At the "Soo" the Edison-Sault Company arranged carriage and steamboat excursions and also provided canoes and Indian guides to carry the more venturesome members of the party through the rapids of the St. Mary's River. The thanks of the ladies and of the association were tendered to the Sault Company and to the General Electric Company for these courtesies.

Westinghouse Banquet to the N. A. S. E.

During the recent meeting of the National Association of Stationary Engineers held at Pittsburg, Pa., the Westinghouse Electric & Manufacturing Company opened their various shops to the delegates attending the convention. They had also prepared for a reception for the visitors, and at 7 o'clock in the evening, September 7, about 600 people, including 200 wives, sweethearts and sisters of the delegates, left the Pittsburg depot, and soon after sat down to a banquet in the erection room of the Westinghouse Company. The train which brought them there was divided into two sections, each being pulled by one of the new suburban electric locomotives. The banquet was probably one of the most peculiar in the history of Western Pennsylvania. For 24 hours the Westinghouse Company had labored to clear the big hall for the event; outside 50 cars were piled up with the big engines whose places were to be taken by the banqueters, and on each side of the hall, 200 feet long by 100 feet wide, machinery was placed, and when the orchestra arrived it could find no place to locate. A happy thought suggested itself and the players were lodged in the big elevator, where for more than three hours they played while going up and down with great regularity. George H. Brown, of the Philadelphia Gas Company, acted as toastmaster. The following toasts were wittily responded to: "Our Guests, the N. A. S. E.," Mr. Judson Pratt; "Our Host, the Westinghouse Machine Company," Mr. Walter C. Kerr; "Pittsburg, its Manufactures and its Homes," Mr. Julian Kennedy; "Our Ladies," Mr. Victor Beutner; "Our Country," Mr. Willis F. McCook. The banquet, which was thoroughly enjoyed by everyone, closed at 10.30, and the special train bore the tired crowd back to Pittsburg, arriving at 11.45. The Westinghouse Machine Company had prepared very handsome menus which were kept by everyone as a souvenir of this memorable occasion.

Thomson-Houston Electric Co. vs. Dayton Fan & Motor Co.

A bill has been filed recently in the United States Circuit Court, Southern District of Ohio, by the Thomson-Houston Electric Company versus the Dayton Fan and Motor Company et al., for infringement of patents No. 363,186, Thomson; No. 428,650, Thomson, and No. 399,801 Thomson & Wightman.

Classified Digest of U. S. Electrical Patents Issued September 6, 1898.

Alarms and Signals:—

COMPRESSED AIR BURGLAR ALARM. W. M. Frisbie, North Baltimore, Ohio, 610,482. Filed June 12, 1897. Consists of pipes extending over the portion of the premises to be guarded, an air compressor connected to the pipes to maintain a constant pressure therein and an alarm device connected to the compressor for sounding an alarm when the pressure in the pipes is relieved by the escape of the air.

Batteries, Secondary:—

SECONDARY BATTERY. G. J. Miller, Kenton, Ohio, 610,190. Filed April 13, 1897. Perforated metallic lead cases surrounding and forming a part of the cells are provided with spaces between the lead cases and the active elements.

Lamps and Appurtenances:—

DIRECT CURRENT REGULATOR. F. E. Ramsay, Walsenburg, Col., 610,413. Filed Jan. 28, 1898. Designed especially for use in connection with any of the ordinary types of direct current incandescent lamps.

Miscellaneous:—

CONTROLLING DEVICE FOR ELECTRIC ELEVATORS. N. P. Otis and R. C. Smith, Yonkers, N. Y., 610,197. Filed April 14, 1892. Details of construction.

MEANS FOR SUPPLYING ELECTRIC CURRENTS TO AGRICULTURAL MACHINES. H. Foerster, Gorsdorf, Germany, 610,350. Filed Jan. 8, 1896. Details of construction.

RESISTANCE AND CONTACT APPARATUS FOR ELECTRIC CURRENTS. H. Lyon, Glasgow, Scotland, 610,406. Filed July 6, 1898. Combines two jars partly filled with a resistance liquid, and having at the bottom metal cups connected to a main conductor, with two cones, one in each jar, suspended from opposite sides of a pulley, the turning of which raises one cone and lowers the other, the cones being connected by wire coils to separate conductors.

MEANS FOR CONTROLLING VOLTAGE AND VOLUME OF ELECTRICAL CURRENTS. H. Williams, Cleveland, Ohio, 610,509. Filed Dec. 8, 1897. A series of cells and resistances interposed between the cells and a line of separate resistances in the circuit beyond the cells, and a switch constructed and arranged to first travel over the cells and lastly over the outside resistances. Designed for dental work.

Railways and Appliances:—

COLLECTOR FOR ELECTRIC RAILROADS. F. S. Pearson, Boston, Mass., 610,241. Filed March 31, 1897. Consists of a contact plate adapted to convey the electricity from the collector, and an ice dissolving material carried by the plate whereby the ice is removed from the conductor.

ELECTRIC RAILROAD. J. C. Henry, Denver, Colo., 610,445. Filed June 30, 1898. A method of accelerating electric motors which are ordinarily independently excited, which consists of starting with the armature and field magnets in series and gradually decreasing the motors' resistance by changing them to independently excited machines.

Switches, Cut-Outs, Etc.:—

ELECTRIC SWITCH. R. L. L. Hundhausen, Wilmersdorf, Germany, 610,402. Filed Dec. 31, 1897. Snap switch.

Telegraphs:—

TELAUTOGRAPH. L. O. McPherson, Highland Park, Ill., 610,274. Filed March 13, 1897. Details of construction.

TELEGRAM TRANSMITTER. E. Porter, Sydney, New South Wales, 610,278. Filed Sept. 4, 1897. Comprises a slidable key having a code plate; a slide having an operative connection with the code plate during its downward movement; a circuit make and break device operated by a slide; a slidably mounted stop-plate having a contact with the slide upon the return movement of the key, the stop-plate serving to retain the slide in a fixed inoperative position, and means connected with the key, for moving the stop-plate at the end of movement of the key.

Telephones:—

TELEPHONE. W. A. Drysdale, Philadelphia, Pa., 610,347. Filed Sept. 17, 1897. Provides a substitute for the ordinary magneto-generator capable of all of the functions of the latter, but of such dimensions as to permit of its inclusion within a casing adapted to hold the other elements of a desk station or outfit.

TELEPHONE. S. S. Fisher, San Francisco, Cal., 610,393. Filed Jan. 14, 1897. Dispenses with the ordinary form of magneto-generator and bell. Details of construction.

Classified Digest of U. S. Electrical Patents Issued September 13, 1898.

Conductors, Conduits and Insulators:—

COMPOSITION CONTAINING CASEIN FOR ELECTRIC INSULATING OR OTHER PURPOSES. P. H. Hansen, Copenhagen, Denmark, 610,626. Filed Feb. 7, 1898. Consists mainly of casein, india-rubber and asphalt in suitable proportions.

Dynamos and Motors:—

COMMUTATOR BRUSH HOLDER. W. K. Bassford, Jr., Bound Brook, N. J., 610,620. Filed Feb. 1, 1898. Embodies a pusher for driving the block against the commutator, and an automatic device for retaining block from the commutator against the action of the pusher.

BRUSH FOR ELECTRICAL MACHINES. J. W. Dickey, New York, 610,705. Filed Dec. 8, 1894. Consists of successive layers of wire-gauze formed into the desired shape, and then compacted by pressure.

Electro-Metallurgy:—

MAGNETIC SEPARATOR. A. Monell, Munhall, Pa., 610,767. Filed Jan. 10, 1898. A wheeled truck having a receptacle, drum arranged to be rotated by the wheels of the truck and carrying electromagnets,

Digitized by Google

and switches for the magnets arranged to be actuated by the rotation of the drum.

Miscellaneous:—

ELECTRIC CLOCK. F. Hope-Jones and G. B. Bowell, London, England, 610,539. Filed Dec. 18, 1897. Embodies an electrically wound regular secondary clock the hands of which are moved through the agency of an electric circuit which operates the secondary clock and means in the secondary clock for opening the circuit.

Regulation:—

APPARATUS FOR STARTING AND CONTROLLING ELECTRIC MOTORS. T. W. Kloman, New York, 610,712. Filed April 4, 1898. An electric motor having its field magnet coils connected permanently in circuit with a main source of current supply, is combined with an independent source of current supply provided with means for connecting it in circuit with the armature of the motor and varying the current relations therethrough, in accordance with the load put upon it, the arrangements being such that the independent source of current supply is never electrically connected with the main source of current supply.

Telephones:—

TELEPHONE SYSTEM. W. W. Dean, St. Louis, Mo., 610,704. Filed Sept. 3, 1897. A system of selective signaling employed in connection with party telephone systems.

REPORTS OF COMPANIES

A Deal Between Westinghouse and Walker Interests.

The following is the official statement given out by the Westinghouse Company in regard to a deal consummated last Friday:

"A representative of the Westinghouse Company said in regard to the report of a union between the Westinghouse and Walker Companies, that the rapid growth of the business of the Westinghouse Company justified the acquiring of the stocks and bonds of the Walker Company on terms which are satisfactory to both parties. The union of interests thereby effected will terminate costly patent litigation which has been going on for the past two years between the General Electric, Westinghouse and Walker Companies."

The terms of the transaction are private, but may be gathered inferentially from the recent issue by the Westinghouse Company of debenture bonds for $3,500,000, of which a large part may have been used in taking up the Walker Company's $2,500,000 first mortgage bonds and an equal amount of stock.

With regard to the adjustments of management, necessary, it is understood that the Walker shops now so busy will continue in full blast. An official of the Walker Company says: "The Walker Company and the Westinghouse Electrical Manufacturing Company have made a combination. They have interchanged securities by which they are closely allied now. Among the principal owners of the Walker Company are J. W. Hinkley, president; R. P. Flower, Anthony N. Brady and Perry Belmont. The first three named will, by the new arrangement, go on the board of directors of the Westinghouse Company. Mr. Perry Belmont will not go on the board of the Westinghouse Company at present. His brother, August Belmont, is already a director of that company.

"This consolidation of interests will result in the cessation of all patent litigation pending between the two companies. It is expected that it will result in the companies getting better prices for products. The combination will make our companies strong competitors with the General Electric Company. While relations are friendly in a general way, the allotment of business will, we expect, be very large to the combination."

The Stanley Co. in the West.

The electrical public will be interested to learn of the recent arrangements made by the Western Electric Company to represent exclusively the Stanley Electric Manufacturing Company in the following territory: Michigan, Ohio, Kentucky, Tennessee, Alabama, Mississippi, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Arkansas, Louisiana, Texas, Indian Territory, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Montana, Wyoming, Colorado and New Mexico. A complete stock of transformers and other appliances to insure prompt shipment will be carried in Chicago. Correspondence is solicited from intending purchasers of alternating apparatus for any purpose, single phase, polyphase, power transmission, transformers, switchboards, instruments, etc., and all orders and inquiries will have immediate attention.

The Atwood Power and Speed Gauges.

We understand that a company is about to be formed for the manufacture of a new line of indicating and recording instruments, designed for steam plants, among them being the Atwood power gauge described fully on the following pages. These instruments will bear the same relation to the steam engine as the ammeter, voltmeter and wattmeter bear to the dynamo, thus enabling the work of the steam engine to be analyzed thoroughly at each instant, and thus permitting of losses being located and minimized. These instruments will also allow of a very close approximation of the work done by the auxiliaries and the boiler, and thus enable the engineer to bring the plant to the highest point of efficiency. The power gauge is at present being manufactured by the Western Electric Company in the New York factory, and can be seen in operation by appointment with the inventor, Mr. G. F. Atwood, at the above address.

THE STOCK MARKET

A Bright and Healthy Outlook.

The rather vague apprehensions as to a tight money market appear to have died down, and, as is noted, "legitimate borrowers have had no difficulty in obtaining all the money they wanted and at rates that in former times would have seemed very moderate." Rash speculators may have suffered from the temporary pinch, but nobody else. Gold is now at the importing point and moving this way, against our large creditor balances in Europe. Other conditions are all favorable for firm prices and trade activity. Railroad earnings and bank clearings remain high. Wheat has advanced a couple of cents, but is more than 15 cents below its level of a year ago. The iron trade is busy, and Bradstreets reports a very fine dry goods demand everywhere.

During the past week 8,198 shares of Western Union were sold, closing at 93. The new General Electric stock is quoted at 78¼, and 2,855 shares were sold. The old G. E. common closed at 43¾. In Boston, American Bell Telephone has been steady around 280. Local lighting and street railway stocks are strong.

Copper is quoted at 12½ cents. The Russian Government has bought 50,000 pounds of aluminum from the Pittsburg Reduction Company.

MECHANICAL

A Direct Reading Mean Effective Pressure Indicator and Power Gauge for Engines.

BY G. F. ATWOOD.

The function of this novel instrument is to continuously measure and give a direct visual indication of the mean effective pressure applied to the piston of an engine, or the average pressure of a series of intermittent pulses, such as those occurring in all reciprocating motors, using steam, air, gas, water, etc., without the necessity of taking indicator diagrams and computing the result therefrom.

It is therefore designed to fill the gap heretofore existing (in direct reading instruments) between the boiler room and the switchboard, and its utility is obviously to provide data whereby the plant may be operated with the intelligent management and care that follows when a full knowledge is obtained of what is taking place in every branch of the system and, therefore, the maximum efficiency consistent with the apparatus in use may be maintained.

In the accompanying engravings, Fig. 1 is a front view of the instrument; and, Fig. 2 shows the method employed in connecting it to the cylinder of an engine; Fig. 3 relates to the dials of the most recent instruments and will be explained hereinafter.

Digitized by Google

It will be noted that three-way cocks are inserted at the indicator outlets of the engine cylinders to which the power gauge and steam indicator are connected and which permit either instrument to be used separately, and also enable measurement to be taken of work done in either end of the cylinder with the power gauge, as described later.

A special reducing motion, not shown in the engravings, connects the instrument with the crosshead which, together with the piping, requires the instrument to be permanently attached, and it is well adapted for continuous service.

The principle upon which the instrument works, broadly speaking, is the measurement of the pressure of steam, or other working fluid, by the velocity of a steam turbine instead of the usual method of balancing its static pressure against a spring; and the mean pressure of a series of impulses is measured through the medium of a steam turbine having a sufficient moment of inertia to render its velocity substantially constant for successive impulses of the motor agent, when those impulses are of equal value.

An instrument constructed to work upon these principles consists of a dynamometer, tachometer, or even a small dynamo adapted to be driven by a turbine motor; this motor in turn being driven by the steam from the cylinder of the engine through two pairs of nozzles, each pair set at such angles as to oppose each other, and connected to the opposite end of the cylinder, by the piping shown in Fig. 2.

The arrangement of nozzles is such, that a minute portion of the steam driving the piston forward passes through what may be termed a + nozzle and acts to drive the turbine in a clockwise direction, while the exhaust steam in the opposite end of the cylinder which is acting to retard the motion of the piston is directed through a — nozzle against the turbine, in such a manner that it retards the forward motion of the wheel, and thus its velocity is the resultant of the two forces acting in opposing directions.

When the piston has completed its stroke the second pair of nozzles are put in service and the first pair shut off through a simple mechanical connection to the crosshead, and the same action takes place during the return stroke, each pair being

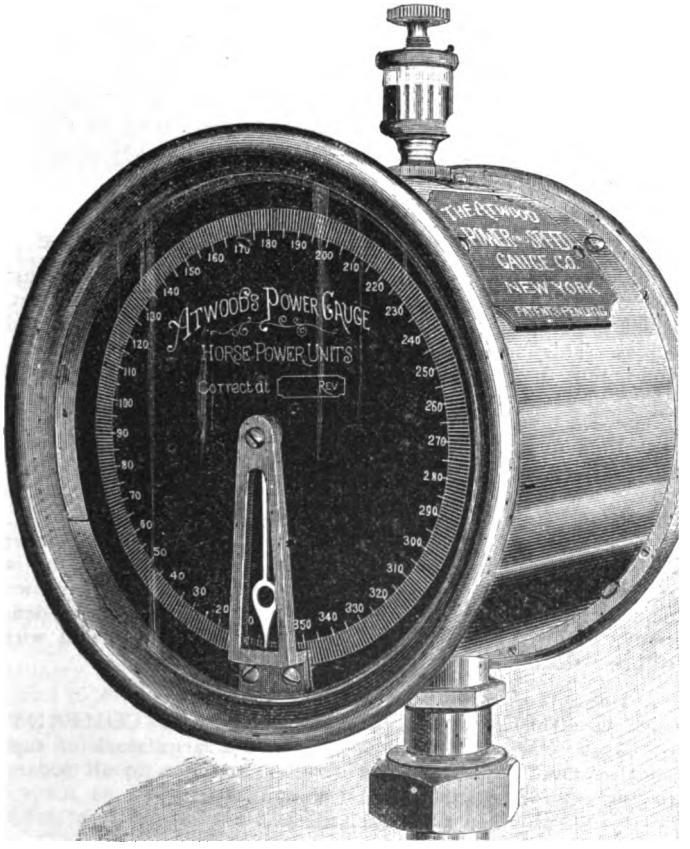


FIG. 1.—THE ATWOOD POWER GAUGE.

alternately opened and closed at the termini of the stroke, and thus keeping the turbine running in a continuous direction.

This arrangement of nozzles is for the purpose of subtracting the back pressure and compression which are negative quantities, while the inertia of the turbine takes care of the varying

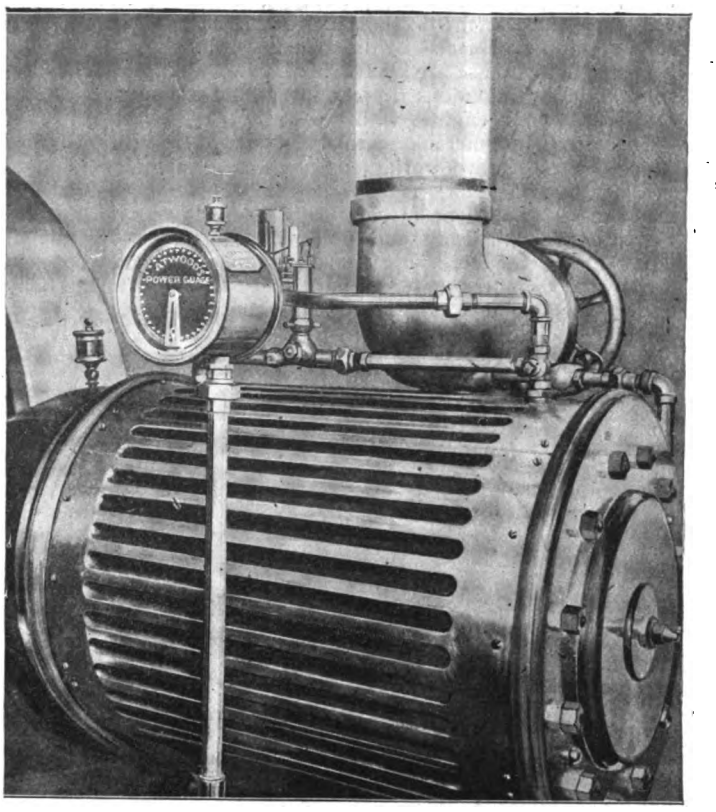


FIG. 2.—ATWOOD POWER GAUGE ATTACHED TO ENGINE.

pressure during the stroke, so that its velocity becomes a measure of the mean effective pressure.

The indicating mechanism acts as a load upon the motor and prevents undue acceleration. It consists of a fan attached directly to the shaft of the turbine and adapted to drive a second fan mounted upon a delicately pivoted shaft and having a retractile spring and an indicating hand or pointer.

As the first fan is rotated by the turbine it tends to rotate the second fan by the current of air set in motion, and the angular deflection is proportional to the velocity of the turbine, which in turn is a measure of the m. e. p.

The dial, as shown in Fig. 3, has an inner scale calibrated to read m. e. p. units and permits the use of the instrument to measure intermittent pressures, while the outer scale is made up of adjustable indices having a numeral surface upon which figures representing horse power are marked Figs. 4 and 5.

The indices are slipped over the periphery of the dial and maintain their position by friction. They are adjusted according to the engine data to their proper positions, by the engineer, by simple calculations from the m. e. p. scale. For instance, suppose an engine having a piston with an area of 176 square inches running at a velocity of 500 feet per minute, 30 pounds m. e. p. would equal 80 h. p., and the adjustable index marked "80" would be set opposite 30 of the m. e. p. scale, and this operation continued with the remaining indices with the result of forming a horse power scale for rough and ready readings. Of course, this applies to governing engines only, as this scale is based on constant speed and for variable speed engines the m. e. p. scale only is used.

The practical application of this instrument has demonstrated the following points of utility: By its use the efficiency of an electric power plant may be more readily and accurately determined than heretofore; in fact, it is practically under observation at all times, and where "logs" are kept a more complete record of the working of the plant is obtained, embracing the coal and water consumption, with the energy delivered to the engines and the output of the dynamos, than was heretofore possible, whereby improvements in the plant, quality of coal, etc., as well as the depreciation may be readily noted and compared.

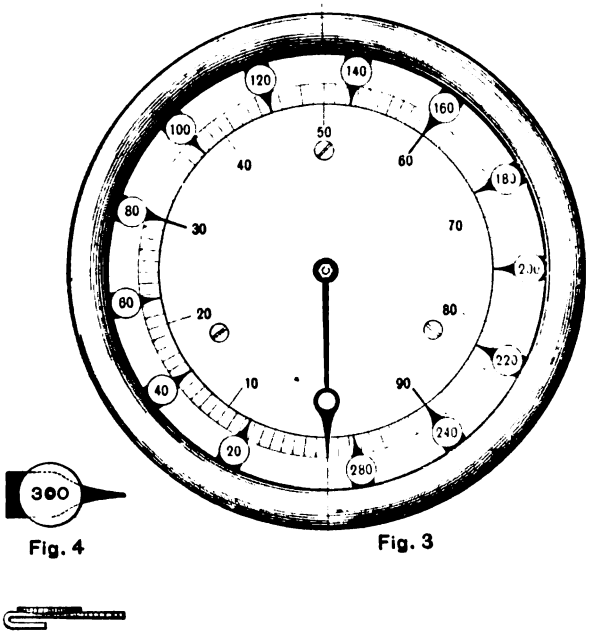
This instrument also furnishes, through visual indications, a variety of other useful data, heretofore only obtainable through

Digitized by Google

the most difficult measurements; in fact, so difficult that they are rarely taken; as for instance, the division of work done between two or more cylinders of engines driving a common and varying load; also the division of work done in either end of a single cylinder of each engine, a feature which will be readily appreciated by those who have tried to obtain satisfactory results with the ingenious devices for taking simultaneous indicator cards upon engines with "see-sawing" governors.

There are innumerable cases where two or more engines coupled together are working at uneconomical points, due to the fact that the work is not divided proportionately, and in these cases, as well as in compound and triple-expansion engines, both condensing and non-condensing, this instrument offers means for observing the distribution of work done in the several cylinders under various loads, and adjustments may be therefore made to obtain the maximum economy.

Other useful data obtainable from the power gauge is the "friction load," this being observed every time the engine is



THE ATWOOD POWER GAUGE.

started, and any friction exceeding the normal amount is readily noted; also the energy required to drive any particular machine or load when proper means are taken for its mechanical separation from the remainder; as, for instance, with arc light machines the energy required to drive each particular machine is readily noted on the power gauge on the engine, when that machine is put in circuit.

These features, together with the fact that the instruments are adapted for continuous service and do not require an expert to manipulate them, renders them an extremely important adjunct to an engine equipment.

Instruments are in service that have been running continuously for eighteen months, and show an error of less than 1 per cent., as compared with indicator diagrams.

Woodbridge's Electric Wire Computer.

This computer, which was shown and greatly admired at the recent Street Railway Convention, has been devised and copyrighted by Mr J. Lester Woodbridge, of Boston, Mass. It is designed for the determination of sizes and weights of wire to carry a given load in amperes, either concentrated at one point or distributed in equal parts at any number of equidistant points. It involves the law of minimum weight of copper for a given drop at the end of the line. With it the track drop in electric railway computations can be ascertained, which drop should be deducted from the total drop allowable and the remainder used for the drop in the overhead lines in computing. The computer consists of a number of revolving discs and a pointer for exact determinations, enclosed in a neat cloth-covered cardboard case, handy for carrying in the pocket, as it measures only 5½ inches square. It has been placed on the market and has found a ready sale at the price of $1.50.

TRADE NOTES AND NOVELTIES

Western Electrical Supply Co.

During the past five years the telephone industry has made remarkable strides all over the country, particularly in the West and Southwest, with the result that many large cities, towns and villages now have a complete telephone service. Many of these exchanges have sprung up, mushroom like, almost in a night, and the majority of them appear to be doing a satisfactory business. As the cost of equipment and maintenance is comparatively slight, the establishment of a telephone exchange in a town of a thousand or more inhabitants seems to be a very excellent business venture.

The Western Electrical Supply Company, of St. Louis, Mo., are, and have been for some time, making a specialty of telephone equipment, and their well-known Western telephone is receiving very favorable comments. The volume of their business in this line is rapidly increasing, which would not likely be the case if they did not handle good goods, which is one of the secrets of success in any business.

The Western telephone is thoroughly up to date and of superior quality, both mechanically and electrically, and service with it, whether for one mile or a hundred miles, is always eminently satisfactory, judging from the very favorable opinions of users thereof.

Hochhausen & Hall.

A new firm under the style of Hochhausen & Hall has just been organized in New York City, with offices at 67 Liberty street. It is composed of H. T. Hochhausen and Charles Hall, both of whom were connected with the Excelsior Electric Co. under the late regime. The intention of the new firm is to execute general construction and repair work of all kinds. They are prepared to furnish promptly parts of machines, etc., their long experience with the Excelsior Company enabling them to appreciate fully the wants and difficulties of station managers. They are located conveniently near to the Brooklyn Bridge, and the ample capacity of their workshops enables them to handle contracts of any size. They will be glad to answer inquiries and furnish estimates.

A New Factory for Roebling Insulated Wire.

John A. Roebling's Sons' Co., of Trenton, N. J., have just completed a new three-story brick building 60 feet by 160 feet, which is devoted to the production of rubber insulated wires and cables. This factory is fully equipped with first-class machinery and is now turning out a large quantity of the highest grade of house wires, car wires and so forth.

The Roeblings have extensive rolling mills and wire mills, with their many apurtenances, and make all kinds of wire, wire rope, trolley and feeder wire for electric roads, electric light and power wires, lead encased cables, telephone cables, submarine cables, and, in fast, every variety of electrical conductors.

Until recently they have supplied to the trade the Crescent rubber wire. It was some disadvantage, however, not to be in position to furnish a wire of this kind exclusively of their own manufacture, but with the fine addition to their works the deficiency has been supplied. The Roebling rubber insulated wire will be a standard article in the market.

H. C. ROBERTS ELECTRICAL SUPPLY COMPANY, 831 Arch street, Philadelphia, Pa., have a large stock of supplies on hand and are giving personal attention to all orders, thereby assuring promptness in shipping.

THE SCIENTIFIC MACHINIST, of Cleveland, O., has absorbed "The Engineer," an old steam paper of New York City, and will hereafter appear under that name, enjoying, it states, a paid circulation of 20,000 copies. The paper will be made more useful and comprehensive than ever.

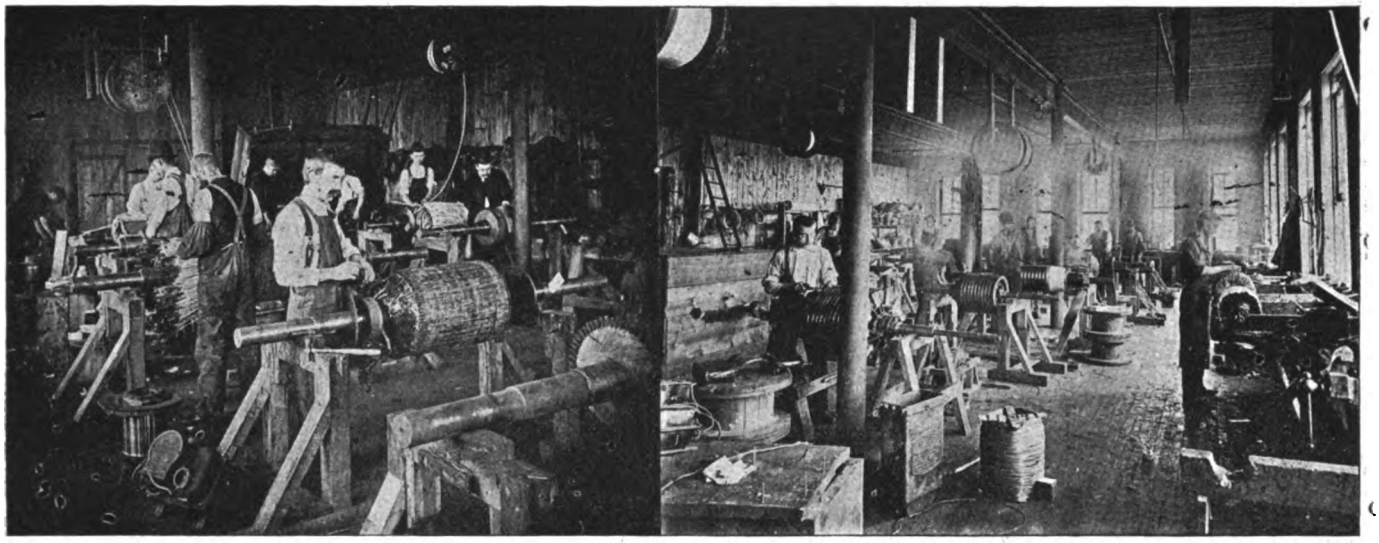
Digitized by Google

Cleveland Armature Works, Cleveland, Ohio.

THIS company makes a business of repairing, rebuilding and redesigning electrical machines, but make a specialty of rewinding fields and armatures. The company has been in existence about four years and enjoys a very liberal patronage, having among its customers at present 325 electric railway and lighting companies, and is equipped for taking care of any amount of work. The works, which are located at the corner of Coe and Hamilton streets, occupy a floor space of 16,000 square feet, and much of the machinery employed is of special design. The work, however, is not confined to winding merely, but they make commutators both from cast and drop forged bars, commutator rings, and all kinds of insulation material which is made up from the raw material. A specialty is made of solid mica rings, and of these the company have supplied as many as 6,000 to one street railway company. Some idea of the amount of work done can be learned from the fact that th eworks consume from 4 to 5 tons of copper wire per month for repair purposes. Where generator armatures are too large to be shipped for repairs, the company send out their own men who make repairs at the station in which the machines are located. About 30 hands are employed in the works besides the gangs that are sent to do outside work. Armatures come in for repairs from every state in the Union, and recently work was going on for customers in Maine and California at the same time.

Steam power is employed for operating the tools and machinery, and there is a generator from which current is employed in testing. A special calibrating instrument is employed for testing. The drying room is partitioned off from the main floor and is equipped with two large drying boxes with coils of steam pipe for heating, with an auxiliary equipment of hand hoists to facilitate the placing of heavy armatures and fields. So complete are the labor-saving appliances of the works and because of the skilled help employed that usually this company are able to quote prices for repairs at what the wire would cost the customer.

A novel feature of the business conducted by this firm is the publication of a monthly paper entitled "The Electrical Buyer," which is sent free to a large number of users of electrical machinery. This publication usually contains a price list of repairs to different types of electrical machinery, with quotations for material, and a current price list of electrical material. This publication also contains the advertisements of a number of manufacturers and dealers in electrical supplies. Another paper known as "The Armature Winder" contains lectures on the diseases of dynamos and motors and their cures and sometimes a catechism relating to electrical affairs. Both publications are very desirable and useful to all users of electrical machinery.



VIEWS IN THE SHOPS OF THE CLEVELAND, O., ARMATURE WORKS.

ADAMS-BAGNALL CO. have received an order from the Detroit Lighting Commission for a further 100 arc lamps.

CATALOGUES.

Huebel & Manger.

Huebel & Manger, 288 Graham street, Brooklyn, N. Y., have issued their latest catalogue, showing a full line of electric bells and push-buttons, which they manufacture. The catalogue will be sent to anyone on application.

Riley Bros., Lantern Slides.

This well-known firm, located at 16 Beekman street, New York, has just issued two very handsome and useful catalogues of their lantern slides. One of these is called a Special War Catalogue and shows the particulars of the Spanish-American war and views of Cuba and the Philippine Islands, a few hundred interesting subjects being contained therein. The other catalogue illustrates a great variety of interesting and instructive slides and contains views and prices of a large number of stereopticons and lanterns manufactured by this company. They also deal in magic lanterns and slide materials, all of which are illustrated in the catalogue.

The Ashton Valve Company.

A very interesting and complete catalogue of the Ashton steam specialties has recently been issued by this company, whose main office and works are located at 271 Franklin street, Boston, Mass. The Ashton patents cover broadly the most valuable and desirable improvements in Pop safety valves and gages made in recent years. They are claimed to be the most perfect and efficient safety valves in the market on account of the correct mechanical principles on which they are constructed. A large number of these valves are illustrated in the catalogue, their advantages pointed out and prices listed. The catalogue describes a great variety and types of steam gages, compound pressure and vacuum gages, as well as a number of clocks for boiler room use. The catalogue, which contains 79 pages, contains besides information about the company's goods, a great deal of useful information for steam engineers. The catalogue will be sent to any one on application.

The Goulds Manufacturing Company.

This company, located at 16 Murray street, New York, have issued several special catalogues illustrating their great variety of pumps. Two of these beautiful catalogues have just reached this office, one of which contains a mint of information about Gould's triplex electric power pumps. These include the electric house pump, a pump for hydraulic elevators, for supplying water, for boiler feeding, fire, mine and fountain purposes, gas

Digitized by Google

engine and power pumps for water works, hydraulic and water supply, generally, besides a chapter on the automatic control of electric and other power pumps and the growing importance of the latter. Both catalogues are amply and handsomely illustrated and contain a great deal of useful information on power pumps in general. The catalogues will be sent to any one on application to the company.

The Paragon Reflectors.

These reflectors, manufactured by the American Reflector & Lighting Co., Chicago, are adapted to general uses, utilizing all the light possible, and distributing it where it is wanted. They are made in a great variety of forms, depending upon the position in which they are to be used; also upon area and shape

PARAGON REFLECTORS.

of space to be lighted, the object being to have each reflector give the best possible results, all things considered. The increased efficiency of light due to the reflectors, as demonstrated by scientific experiments, varies from 300 to 400 per cent., the average increase with reflectors being over four times that without reflectors. We illustrate two of the many forms in which these reflectors are made.

ADVERTISERS' HINTS

THE GENERAL ELECTRIC COMPANY call attention to their lamp inspector's indicating wattmeters for alternating and direct current circuits.

THE BEACON LAMP COMPANY, New Brunswick, N. J., guarantee their incandescent lamps to average a maintenance of their initial candle powers (at standard efficiencies) for over 300 hours and to have an average life of over 600 hours.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., are this week advertising belt-driven polyphase generators.

ARC LAMP SPECIALTIES and trolley line material are offered by the Creaghead Engineering Company, Cincinnati, O.

THE CABINET MANUFACTURING COMPANY, Steubenville, O., manufacturers of telephone cabinets, boards and battery boxes, have changed their style to the Cabinet Manufacturing and Supply Company, and are now located at Cleveland, O.

THE FRONTIER IRON WORKS, 12 Chene street, Detroit, Mich., are building a style of gas engine specially adapted for electric lighting plants. The Yaryan Company, Times Building, New York, are the Eastern agents.

THE INDIA RUBBER AND GUTTA-PERCHA INSULATING COMPANY, 15 Cortlandt street, New York, advise that, owing to the advance in the cost of rubber and copper, that they are obliged to withdraw all quotations on "Habirshaw" wires. They are preparing a new list, and in the meantime will be pleased to quote prices on application.

CHAS. E. GREGORY COMPANY, Chicago, submit an up-to-date list of the large stock of machinery they carry and are offering at bargain prices.

ANNUNCIATORS AND BELLS are advertised by Partrick, Carter & Wilkens, 125 South Second street, Philadelphia.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, are desirous of sending their revised list on sockets, receptacles, cut-outs, tubes, cleats and insulators to those interested.

THE THIRD-RAIL SYSTEM of electric traction on the Long Island Railroad is being installed by the Willard Third-Rail Electric Company, 27 William street, New York.

HOCHHAUSEN & HALL, 67 Liberty street, Brooklyn, N. Y., will furnish estimates on all classes of electrical repair work.

TELEPHONES embodying new features exclusively their own, are advertised by De Veau & Co., 29 Rose street, New York

WESTERN NOTES

RECENT FLUCTUATIONS in the prices of sockets, receptacles, cut-outs, insulators, etc., have made it somewhat difficult for the ordinary buyer to keep track of the market prices on these goods. The Electric Appliance Company have just issued a special price list of all this material, giving trade prices that are strictly up to date. It is in the form of a small circular, which should be of considerable value to the purchaser of staple electrical supplies.

KANSAS CITY, MO., is contemplating the purchase of a fire and police system, and inquiries, etc., should be addressed at once to the city officials.

CONTENTS.

EDITORIALS:
Spare Armatures 290
Rail Bonding 290
Electricity as the Feeder of the Race 290
Practical Wireless Telegraphy 291
The Westinghouse-Walker Consolidation 291
MISCELLANEOUS:
Consideration of the Multiphase System for Central Station Service (illustr.) .....W. S. Kelley. 281
The Illegitimate Watt .....Jacque L. Morgan. 284
ELECTRIC TRANSPORTATION:
Cleveland & Chagrin Falls Electric Railway Co. (illustr.)..... C. B. Fairchild. 285
Equipment and Maintenance of Electric Cars—II...M. S. Hopkins. 287
Inspection and Testing of Motors and Car Equipments by Street Railway Companies .....Fred'k B. Perkins. 288
LITERATURE:
Goldman's "Arithmachinist" 289
ELECTRIC LIGHTING:
Positive and Negative Economies on the Operation of Small Electric Light Plants—II. .....E. P. Roberts. 292
Testing Arc Light Circuits—II.....W. H. Markland. 293
LETTERS TO THE EDITOR:
Yellow Journalism and Society Badges .....Ralph W. Pope. 294
Water Supply for Power in California ..... Redlands Elec. Lt. & Pr. Co. 294
Automatic Motor Starting Boxes.....Raster Carbon Rheostat Co. 294
TELEPHONY AND TELEGRAPHY:
A Farmers' Co-operative Telephone System Around Mansfield, O... Henry T. Manner. 294
POWER TRANSMISSION:
Portable Electric Pump Outfit in a California Winery (illustr.).... 295
ROENTGEN RAYS:
The Edison Portable Cabinet X-Ray Outfit (illustr.)..... 295
PERSONAL:
Capt. Samuel Trott.—Prof. R. B. Owens..... 296
EDUCATIONAL:
The Correct Theory and Method of Organization and Conduct of Professional Schools .....Prof. R. H. Thurston. 297
SOCIETY AND CLUB NOTES:
Manhattan Beach Meeting of the New York State Street Railway Association 297
Nineteenth Convention of the Association of Edison Illuminating Companies 298
Westinghouse Banquet to the N. A. S. E..... 299
LEGAL NOTES:
Thomson-Houston Elec. Co. vs. Dayton Fan and Motor Co..... 299
INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Sept. 6, 1898.. 299
Classified Digest of U. S. Electrical Patents, Issued Sept. 13, 1898. 299
REPORTS OF COMPANIES:
A Deal Between Westinghouse-Walker Interests.—The Stanley Co. in the West.—The Atwood Power and Speed Gauges..... 300
THE STOCK MARKET:
A Bright and Healthy Outlook 300
MECHANICAL:
A Direct Reading Mean Effective Pressure Indicator and Power Gauge for Engines (illustr.) .....G. F. Atwood. 300
TRADE NOTES AND NOVELTIES:
Woodbridge's Electric Wire Computer.—Western Electrical Supply Co.—Hochhausen & Hall.—A New Factory for Roebling Insulated Wire.—H. C. Roberts.—The Scientific Machinist 302
Cleveland Armature Works, Cleveland, O. (illustr.).—Huebel & Manger.—Riley Bros.' Lantern Slides.—The Ashton Valve Co.—The Goulds Mfg. Co. 303
Paragon Reflectors (illustr.).—Advertisers' Hints.—Western Notes. 304

Department News Items will be found in advertising pages.

Digitized by Google

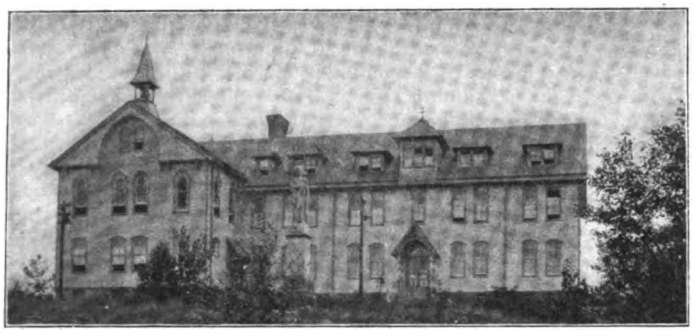
The Electrical Engineer.

Vol. XXVI. SEPTEMBER 29, 1898. No. 543.

The St. Joseph Sanitarium Electric Plant.

BY H. B. COHO.

IN writing a description of an electric light plant in these days, when almost every town, manufacturing establishment or mill is supplied with such a plant, it is almost impossible to make the description as interesting as it would have been several years



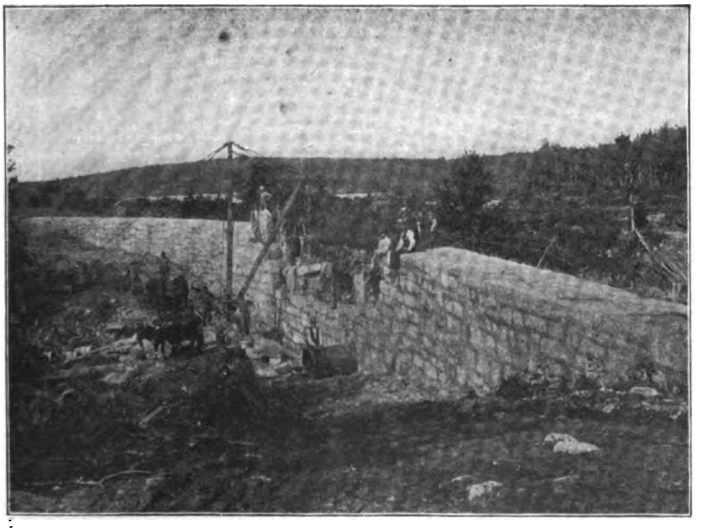
ONE OF THE MAIN BUILDINGS, ST. JOSEPH SANITARIUM.

ago. I feel, however, that the plant which has just been completed by the writer for the Sisters of St. Dominic, a Catholic Order run entirely by the Sisters, has some points which may prove of interest to the reader.

The St. Joseph Sanitarium is located in the heart of the Sullivan County Mountains and is six miles from the town of Monticello and three miles from Gilman's Station. It can readily be seen, therefore, that any saving in coal would be an item in the hauling alone, and the success that we have had in harnessing the brook has made a tremendous saving right at the start.

In order that the reader may fully understand our system, I will take up the details in order, dealing with each item.

Wiring in Buildings.—The sanitarium proper consists of six



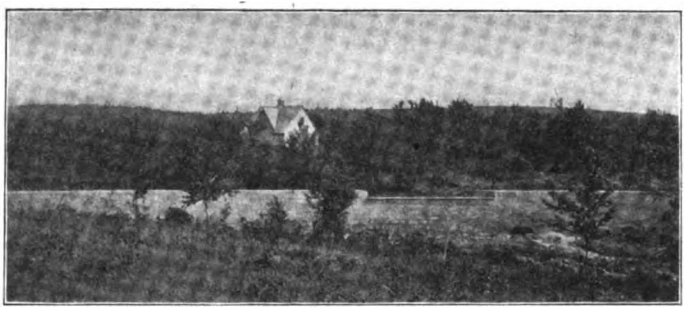
STORAGE WATER BASIN WITHIN DAM WALL.

large frame buildings, built on the various hills and included in a radius of about half a mile. The buildings all being of wood, special care was taken to insure against fire and the wires were separated six inches and run in porcelain or iron tubes wherever they came nearer. Special care was taken to place all switches in as convenient places as possible, and great care given to insure an abundance of light, the use of water making economy in this direction needless.

Illumination of Grounds.—The grounds and walks thereon are illuminated with 100-hour long-burning arcs, and the unfamiliar tourist coming suddenly on this mountain resort would imagine himself back in the heart of the city. The arcs have demonstrated that it is entirely feasible to run alternating current long-burning arc lamps and get good results.

Pole Line.—All the wires are carried on poles, and transformers are placed on poles at least 50 feet from the buildings. The transformers used throughout are of the Scheeffer type, manufactured by the Diamond Electric Company, of Peoria, Ill. The telephone lines are carried on the same poles with the electric light wires. The various buildings and stables are connected by telephone, the main switchboard being in the administration building.

Electric Plant.—The generating plant consists of a 1,000-light Warren alternator, a Stillwell-Bierce horizontal turbine wheel governed by a Snow governor, and a marble switchboard. All



DAM WALL FOR WATER POWER, ST. JOSEPH SANITARIUM.

the lights are controlled by the switchboard, and the operator has the whole plant at his command. The voltage of the generator is 1,100, transformed at the buildings to 110. The dynamo is of the inductor type, and nowhere can a plant be found requiring less attention. I was particularly impressed with the ease and small attention with which the plant could be run. The attendant has only to keep oil in the bearings to have a successful plant.

The Dam.—The Black Brook, which flows through the property, is part of the headwaters of the Delaware River. It has a fall of 70 feet on this property, but is merely a brook at best. In order to get the storage required we were obliged to build a dam 250 feet across and 20 feet high. This makes a basin of nearly a

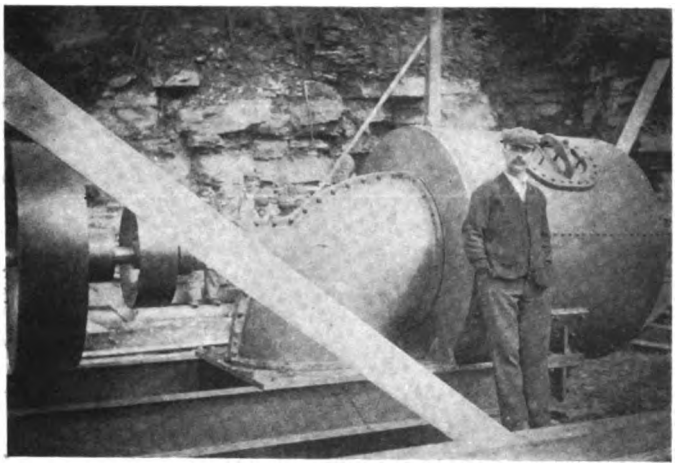
VIEW OF POWER HOUSE, SHOWING TAIL RACE.

mile in area and will hold water enough to run the entire plant 52 days without rain. The dam was built entirely of stone hewn on the site, and was laid in best porcelain cement throughout.

Digitized by Google

Superintendence.—The work at the place was superintended throughout by Mr. John H. Barker, assisted by Mr. G. Irving Righter. The contract was carried through by the firm of H. B. Coho & Co.

The successful running of this plant leads me to suggest that



TURBINE GENERATING PLANT, ST. JOSEPH SANITARIUM.

any large institution or others requiring light and power will do well to investigate any water power in their vicinity. The advantages are so well known that they need scarcely be enumerated. They are particularly noticeable in the saving of attendance, the saving of fuel, and, above all, that every year instead of paying for fuel, etc., the light bill is constantly applied on the first investment, and I venture to say that properly equipped water power will earn more than any other form of power with less care and annoyance, provided, of course, one has a market for the power.

Electric Door Openers for Elevators.

PNEUMATIC door openers for high-class elevator installations in the most modern office buildings are not quite common, and it may very likely have been a cause of wonder to many electrical engineers that something in the way of an electric door opener has not been developed for the same class of elevator service. As to the time-saving qualities of the pneumatic door opener, there is no longer any room for doubt. From two to three seconds are saved, at least, every time the car is stopped to let on or discharge passengers, and this is an advantage by no means to be disregarded in modern office building service where it is desired not only to get as much good as possible out of each elevator car, but also to land passengers as expeditiously as possible. Nothing adds more to the attractiveness of an office building from the tenant's standpoint than a rapid elevator service equipped with all improvements.

As a matter of fact electric elevator door openers have been worked out which run admirably and in every way as well as the pneumatic door openers, but the cost of installation is at present so much in favor of the pneumatic device that the electric has found little use. A representative of The Electrical Engineer was recently accorded the courtesy of investigating the results of some work in the magnetic elevator door opener line, which has been carried on by Mr. H. Rowntree, of the Burdett-Rowntree Manufacturing Co., Chicago. The same company also makes the greater number of the pneumatic door openers in use and has many patents on both electric and pneumatic systems.

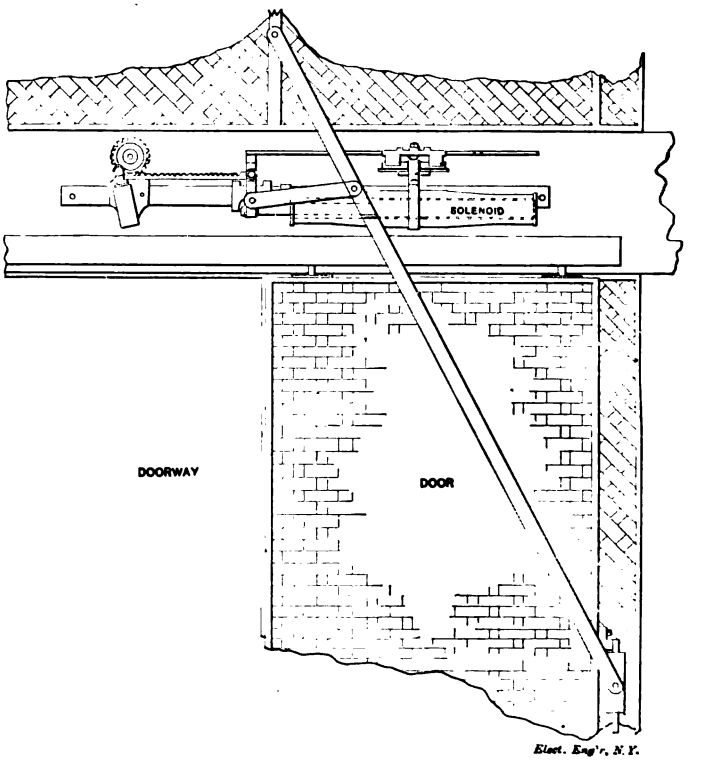
There are a number of general methods of arranging an elevator door opening device. The pneumatic cylinder or magnetic solenoid, as the case may be, may be put on each door and the valves or switches tripped by a device worked on the car as it nears a floor. A second way is to put the solenoid or pneumatic cylinder on the car and arrange a mechanical connection between the motive power on the car and the door. This has the advantage of being cheaper than the first method, because instead of equipping each door with a solenoid or air cylinder it is only necessary to equip each car, thereby reducing the number of solenoids or air cylinders by a number equal to the number of floors in the building minus one. The cost of wiring in the shaft is also somewhat reduced, though the mechanical contrivances around each door are greater than with the motive power located permanently at each door.

This method of putting the motive appliance on the elevator car has been found impractical on account of the noise of the mechanical devices necessary to provide for the engagement of the motive apparatus on the car with the door apparatus. A third system consists in putting all the motive appliances in the basement and connecting them with the doors on the various floors mechanically. This is too complicated for ordinary conditions. The system employing a solenoid or air cylinder at each door is found to be the best, all things considered.

Before going into the magnetic door operating device it must be remembered that the pneumatic door opener which has proved such a success is operated usually by a foot treadle or button on the floor of the car near the elevator man. When the car is to be stopped at a floor or after it has been stopped the operator presses this button with his foot, which has the effect of causing a mechanical device on the car to engage with the air valves operating the air cylinder. Air is admitted to the cylinder to open the door and the door remains open as long as the foot button is held down. When the foot button is let up or when the car leaves a floor the air valves are set to close the door and hold it shut. The admission of the air to the cylinder by the valves has been made a matter of careful study in order to get prompt action and the right cushioning effect. This explanation of the air device is made for the benefit of those not familiar with its working (for many see it work daily without understanding it), and in order that the electric device about to be described may be better understood.

In the electric door operating device the work is done by a double solenoid of peculiar shape. As shown in the accompanying engraving, it is placed at the top of the door. The two solenoid coils which operate on the same core are shown in outline only, with their interior core indicated by dotted lines. The right hand coil is the one which acts to open the door and the left hand coil acts to close it. The rack and pinion and air cylinder at the left of the solenoid comprise a pneumatic cushioning device. The switch controlling the solenoid coils is shown on top.

When the operator on the car wishes to open the door he



ELECTRIC ELEVATOR DOOR-OPERATING MECHANISM.

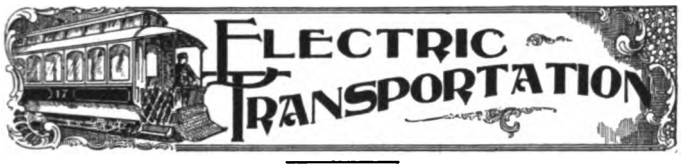
presses a foot button just as with the air system and a mechanical device on the car trips the solenoid switch instead of tripping the air valve as on the pneumatic opener. The solenoid then promptly draws the door open. When the elevator man releases the button or when the car leaves a floor the switch is

Digitized by Google

tripped the other way, the left hand coil of the solenoid is brought into play and the door is drawn shut. Just as the door is closed the switch controlling the left hand solenoid coil is automatically opened so that there is no consumption of energy when the device is not in use.

It will be noticed that the two solenoid coils are wound tapering; that is they are about two-fifths larger in the middle than at the outer ends. This shape, which is shown, has been found by actual experiment to give the proper variations in pull over the range of the solenoid. Thus, with the door open and the iron core in the position shown, the pull is 80 pounds, which is the maximum and is needed to promptly overcome the inertia of the door. When the door is half closed this pull falls to 30 pounds, which is all that is needed with the door in motion. When the door is almost closed the iron core of the solenoid gets so near to the iron plate at the end of the coil that the pull is increased to fifty pounds, due to the improved magnetic circuit. This increased pull is just what is wanted to insure the door being shut tight.

Such is the construction and operation of a device that is in its practical working fully equal to the air device, but, as said before, it is to be regretted that the first cost of the air device is less at present. The electric device has no piston packing to get cold and retard action, as sometimes happens with air devices, and 110-volt circuits are sometimes more convenient than compressed air pipes. Perhaps these advantages, together with some unforeseen cheapening of the cost of construction of the electric door operator will eventually bring it into more common use.



Cost of Electric Power for Street Railways at the Switchboard, Both Steam and Water Power.[1]

BY R. W. CONANT.

IT is my privilege to be able to communicate to you facts and figures bearing on the operation of forty-four power stations located at the important street railway centres throughout the country.

These figures cover for the most part the operation of the stations during the past year and were obtained through the kindness of members of this association as well as from experience on the roads in Boston.

The aggregate capacity of power stations represented is 98,387 k. w., or 131,800 electrical horse power. The total cost of operation for the production of power alone from these stations during the past year has been $1,825,000, and if the power had been produced by all at as low a cost as it was in a number of the more economical stations the saving for the year would have amounted to $443,300. It is the chief purpose of this paper to explain the "if" and to obtain some idea of its size.

In the analysis of costs of operation of power stations of various sizes and types it is first necessary to adopt a standard for the unit of power. The car mile is unreliable. Recording wattmeters are at present constructed which will measure the output in kilowatt hours. They can be made to give results which are accurate within a very few per cent.

It was evidently the idea of your executive committee in limiting the title of this paper to cost at the switchboard to abolish the car mile and adopt the kilowatt hour as the unit of power. And in comparing the costs from the various stations I shall use this unit. For the benefit of those who are accustomed to considering the costs per car mile it will be interesting to know that on many roads a car mile takes just about 1 kilowatt hour. This is not true where grades and equipments are extremely heavy; in such cases two or three times this amount may be required.

In the costs of power, whether it is produced by steam or water, should be included the fixed charges as well as the cost of operation. Under fixed charges are interest, depreciation, insurance and taxes on the capital invested in the land, buildings and machinery of the power station. Under operating expenses are fuel, labor, supplies, repairs, superintendence and general expense. In both the fixed charges and operating expenses the component items vary between widely different limits, and it becomes impossible to construct a law that will predict the cost under all circumstances. On the other hand, for one who has had experience it is comparatively easy to predict what the power ought to cost under a given set of conditions. What it will cost must, of course, depend on management as well.

In view of the variety of the circumstances governing these costs I have deemed it advisable to establish, for purposes of comparison, a standard plant whose conditions are fixed, based on facts obtained from stations in actual commercial operation during a long period of time. I shall assume the station to be located on the water front, the exact spot is unimportant, but since this association has chosen Boston as its meeting place we can consistently locate the station here as well. I have fixed the capacity at 3,600 k. w., the building erected on firm ground requiring but little piling or filling, building and chimney of brick.

For equipment, three cross compound condensing engines, cylinders 28 inches and 56 inches by 5 foot stroke. Speed, 80 revolutions per minute, 150 pounds steam pressure. Three 1,200 k. w. direct connected generators, six water tube safety boilers, 500 h. p. each. Economizers and exhaust feed water heaters, electrically driven feed pumps and coal handling apparatus. Such a station would cost to install as follows:

CAPITAL INVESTMENT.

Building, foundations for engines and boilers, chimney, coal handling apparatus	$120,000
Engines and condensers, heaters, separators and piping	91,800
Feed pumps and economizers	18,000
Boilers and flue connections complete	61,000
Generators and switchboard, complete	73,800
Land and docking facilities	17,000
Engineering and sundries	5,000
Total	$386,600

Or about $107 per kilowatt capacity.

To obtain the figures for fixed charges I assume interest at 6 per cent.; insurance and taxes, 3 per cent.; depreciation, 2 per cent.; total, 11 per cent., which makes an annual fixed charge of $42,526.

I shall assume that this station produces 10,500,000 kilowatt hours per annum; dividing the annual charge by this figure gives 4 cents per kilowatt hour for the fixed charges. The depreciation is not intended to cover repairs, which will be included under operating expenses. The 2 per cent. assumed for depreciation is to establish a sinking fund against the time when the station will have to be entirely replaced by one of more modern and economical design, time of replacement being taken at fifty years.

Before arriving at the cost to produce power from this station, it will be necessary to obtain the operating expenses. In making comparisons between stations of different sizes and types, the cost of labor is the most perplexing item. Some stations operate with two shifts, others three. Some have engineers paid at different rates, and men who appear on the records of some are in a capacity which in others is absent or replaced by men of another class and rate of pay. I therefore give the following method of analysis of the labor item which gives satisfactory results when applied to station operation.

I can illustrate the method and at the same time derive the operating expenses by applying it to our standard station. It is assumed that this station operates with three shifts of men, the duration of each shift being eight hours. This makes the shift hours per day 24, or 8,760 for the year. The same number of shift hours would, of course, be obtained by two shifts of twelve hours each, as is the case with some stations. For the three-shift station the first two probably would have the full complement of men, while the third would not, as the station might be shut down on that shift. But, as there is considerable inspection, cleaning and overhauling, this shift requires almost as many men, though their rate of pay may be less. The highest rates of pay would be on the shift of heaviest load. The crew to operate the standard plant would be about as follows: Two engineers, one oiler, one helper, two firemen, one coal-passer; total, seven men per shift.

The average rate of pay per man is taken at 27 cents per hour. This would be calculated from an actual station by dividing the total amount paid for wages, including chief engineer's salary,

[1]Read before the Am. St. Ry. Assoc. Abstract.

Digitized by Google

by the product of the number of men operating with the hours each has worked. The number of men per shift for this station being seven, I will divide this figure by 3.6, which is the figure expressing the capacity in 1,000 k. w. units. This division gives 1.94 as the number of men per shift per 1,000 k. w. capacity. This figure will vary with the type and size of station, as we shall see later. The fractional part of the man, of course, only appears in figuring.

Multiplying the 1.94 by the rate of pay, 27 cents, gives 52 cents as the cost of labor per hour per 1,000 k. w. capacity. This, multiplied by 3.6, the number of 1,000 k. w. capacity, gives $1.87 as the total cost of labor required to operate the station per hour.

It will further aid in the analysis of the labor item to introduce the load factor. As this term is sometimes employed in a different sense from that used in this paper, I shall define it to be that per cent., which, when multiplied by the capacity of the station in kilowatts and by the shift hours for the period, gives the kilowatt hours' output for the time considered. I take as the load factor for this station 33.3 per cent. average for the year.

labor per kilowatt hour for any station is to multiply the rate of pay of the men by the number of men per 1,000 k. w. capacity and divide by the product of the load factor and 1,000.

The use of this method will be illustrated if we compare the cost of labor per kilowatt hour in the first two columns of table No. 1. It is .157 for the standard and .56 cent for station No. 1. It is rather difficult to account for this great increase until we notice that the men per 1,000 k. w. is 4.7, as against 1.94. The rate of pay and load factor also enter, as I shall show later.

I have constructed a diagram (Fig. 1), which gives the results of this expression for cost of labor for all usual rates of pay, load factors and men per 1,000 k. w. This diagram is based on a rate of 27 cents per hour, and there is also given a reduction table which gives the per cent. to be added or subtracted for other rates than this. To illustrate its use, suppose we have a station whose equipment requires five men per shift per 1,000 k. w. capacity. During a month of high output it might operate at a 30 per cent. load factor. On the diagram, following 5 up to 30, gives cost of labor at .45 cents per kilowatt hour. In a

	No. of Station.	S.	1	2	3	4	5	6	S.	1	2	3	4	5	6	S.	1	2	3	4	5	6
Cap. in 1,000 k. w		3.6	.6	2	1.6	12.08	2.38	.744	3.6	.6	2	1.6	12.68	2.38	.744	3.6	.6	2	1 6	12.08	2.38	.744
Type.	Units E	3	3	2	2	8	2	4	3	3	2	2	8	2	4	3	3	2	2	8	2	4
	Units G	3	3	2	2	8	7	12	3	3	2	2	8	7	12	3	3	2	2	8	7	12
	Units E per 1000 k. w	.83	5	1	1.25	.63	.84	5.4	.83	5	1	1.25	.63	.84	5.4	.83	5	1	1.25	.63	.84	5.4
	Units G per 1000 k. w	.83	5	1	1.25	.63	2.94	16.2	.83	5	1	1.25	.63	2.94	16.2	.83	5	1	1.25	.63	2.94	16.2
	B. D. C	D C.	D.C.	D.C.	D.C.	D.C.	B.	B.	D.C.	D.C.	D.C.	D.C.	D.C.	B.	B.	D.C.	D.C.	D.C.	D.C.	D.C.	B.	B.
	S. C. T	C.	C.	C.	C.	C.T.	T.	S.	C.	C.	C.	C.	C.T.	T.	S.	C.	C.	C.	C.	C.T.	T.	S.
	N. or C	C.	C.	C.	C.	C.C.	C.	N.	C.	C.	C.	C.	C.C.	C.	N.	C.	C.	C.	C.	C.C.	C.	N.
Period.	Days	365	365	343	365	365	365	365	31	31	31	31	31	31	31	30	30	30	30	30	30	30
Load Factor.	Per Cent	33⅓	22.3	33.6	46.4	34.8	52.2	47	33⅓	30	50.6	58.6	46.4	64	48.4	33⅓	17.7	28	43.2	27.6	42.6	48
	Per Cent. of S	....	67	101	139.5	104	157	141	....	90	152	176	140	192	145.5	....	53.2	84	130	83	128	120
Labor. Cost in Cts	Shifts	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Duration	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Shift-hours	8,760	8,760	8,232	8,760	8,760	8,700	8,760	744	744	744	744	744	744	744	720	720	720	720	720	720	720
	Men per 1000 k. w	1.94	4.67	2.91	3.36	1.9	4.79	5.95	1.94	4.66	2.95	3.24	1.93	4.98	6.36	1.94	4.98	3	3.8	1.77	4.5	6
	Rate-pay	27	26.8	25.7	25.8	28.6	26.6	25.8	27.	26.5	26.2	25.	20.	25.8	25.6	27.	25.	25.6	24.4	28.4	27.6	24.2
	Per k. w. hour	.157	.56	.228	.257	.156	.942	.821	.157	.41	.153	.128	.121	.198	.236	.157	.705	.273	.215	.183	.302	.238
	Per Cent. total op	27.	46.7	32.5	29.4	22.6	28.7	29.1	27.	47.	27.2	23.	18.3	26.8	27.7	27.	51.4	40.6	32.5	26 9	31.8	31.7
	Per Cent. S	....	356	149	119	99.1	154	204	....	261	97.4	86	77	127	214	....	448	174	127	116	186	215
Fuel. Cost in Cts	Lbs. per k. w. hour	2.2	3.18	2.48	2.61	2.86	3.24	4.13	2.2	3.07	2.86	2.65	2 74	3.19	4.74	2.2	3.3	2.84	2.48	2.84	3.3	4.05
	Price per short ton $	3	2.6	2.62	2.6	2.73	2.6	2.9	3	2.75	2.65	2.54	2.88	2.71	3.08	3	2.48	2.56	2.53	2.43	2.56	2.44
	Kind, A or B	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B.	B.	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B.	B.	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B.	B.
	Per k. w. hour	.33	.414	.325	.340	.389	.42	.509	.33	.421	.313	.337	.395	.430	.729	.33	.409	.299	.314	.345	.423	.494
	Per Cent. total op	57.	34.5	47.4	51.6	55.2	49.7	54.3	57.	42.	55.6	56.4	50.9	58.4	60 1	57.	29.8	41.3	47.5	48.8	40.1	46.4
	Per Cent. S	....	125.5	98.5	103	117.5	127	138	....	127.5	94.5	103	120	130	220	....	194	91	95.	104	128	140.5
Repairs, Supplies & Supt. & Gen. Exp.	Per k. w. hour	.098	.235	.138	.138	.159	.188	.188	.098	.172	.0975	.123	.144	.109	.147	.098	.268	.102	.133	.176	.208	.268
	Per Cent. total op	16.	18.8	20.1	20.	22.6	21.6	16.5	16.	17.	17.2	20.6	21.81	14.8	12.2	16.	18.8	15.1	20.	25.1	22.1	21.9
	Per Cent. S	....	242	148	142	171	196	196	....	185	105	152	155	117	.153	....	278	110	143	189	218	250
Total Oper. Cents.	Per k. w. hour	.58	1.198	.686	.659	.794	.845	1.102	.58	1.008	.563	.598	.66	.787	1.212	.58	1.272	.674	.662	.708	.918	1.065
	Per Cent. S	....	205	118	114	128	146	190	....	172.5	97.	103	114	127	208	....	220	116	114.5	121	157	184
Fixed Charges	Per k. w. hour	.405	....	....	....	....	....	....	.405	....	....	....	....	....	....	.405	....	....	....	....	....	....
	Per Cent. total op	70	....	....	....	....	....	....	70	....	....	....	....	....	....	70	....	....	....	....	....	....
	Per Cent. S	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Grand Total		.985	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

TABLE I.—SHOWING COST OF OPERATION OF RAILWAY POWER STATIONS.

You may remember that in the consideration of the fixed charges I gave as the kilowatt hours per year 10,500,000, which is 33.3 per cent. of 3,600 k. w., multiplied by 8,760, the shift hours per annum.

It has been shown above that $1.87 is the average cost of labor to operate the station for one hour, and if we obtain the average kilowatt during the hour, which is kilowatt hours for that period, a simple division will give the figure for the cost of labor per kilowatt hour. The load factor gives the means of obtaining the kilowatt hours, and by multiplying 3.6 by 1,000 and 33.3 per cent. gives 1,200 as the average kilowatt for the hour, or kilowatt hours for that period. Dividing $1.87 cost of labor to operate the station per hour by 1,200 gives .157 cents as the cost of labor per kilowatt hour. But 3.6, the figure representing the capacity, was used as a multiplier in obtaining both the cost of labor, $1.87, and 1,200 k. w. hours. It therefore disappears in the division, and the expression for the cost of labor per kilowatt hour is made independent of the capacity of the station to that extent. The rule, then, for obtaining the cost of

lighter month the station might operate at a 15 per cent. load factor. Following 5 up to 15, gives .9 cent, or twice as much for labor per kilowatt hour.

To further illustrate the use of this diagram, let us consider that the equipment of our standard station is cut into so many units that it required 3.7 men instead of 1.94. Price of labor and load factor being 27 cents and 33.3 per cent., respectively. Then 3.7, followed on the diagram up to 33.3 per cent., gives .3 of a cent, as against .157 cents for the standard.

The cost of fuel is the next item to be considered in the operating expenses of the standard station. Considering coal as the fuel used, its cost per kilowatt hour depends on the price per ton and on the efficiency of the station, which is best expressed in pounds coal consumption per kilowatt hour. The coal for standard station I have assumed to be clear bituminous, costing $3 per short ton delivered.

As to the efficiency, I am able to quote from tests in which I was personally engaged on a station of the same size and similar equipment. The duration of the test was 45 hours, made under

Digitized by Google

actual conditions of railroad service during the day, and at night the load was kept on the station by means of a water rheostat. I will say here, however, that the test on the steady night load did not show any great gain in efficiency due to the fact that the day load of the station was steadied by feeding in with others. The average efficiency of transformation i. h. p. to e. h. p. at the switchboard was 90 per cent The steam consumption of the engines was 14.5 pounds per i. h. p. hour. This record on a later test has been lowered. The boiler evaporation was 9.4 pounds water per pound of coal from actual conditions. The coal used was New River bituminous. The economy of the station, represented by the coal consumption in pounds per kilowatt hour, was 2.3. I have assumed 2.2 for this figure for the standard station.

Reducing price per ton to price per pound and multiplying by 2.2 gives .33 cent as the cost of coal per kilowatt hour. This appears in table No. 1 under cost of fuel. As an illustration of what the cost would have been had the engines required more steam, say 266 pounds per i. h. p. hour, as might be the case with a non-condensing engine. Referring to the fuel diagram (Fig. 2) and considering the electrical efficiency, boiler evaporation and price of coal to remain the same, 26.6 to 9.4 pounds of water per

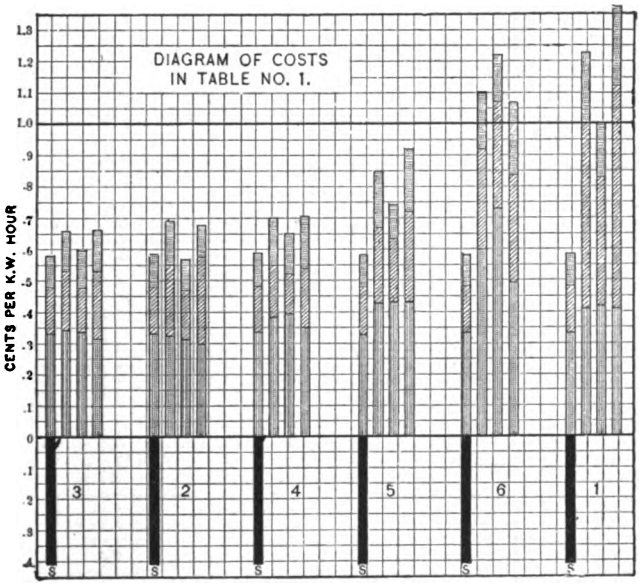


DIAGRAM OF COSTS IN TABLE No. 1.

pound of coal gives 3.8 pounds coal per kilowatt hour. Following this line down to horizontal $3 coal line and vertically upwards from this point to cost of fuel in cents per kilowatt hour, we obtain .57 cent, were the efficiency of transformation 100 per cent., but, since it is assumed to be but 90 per cent., 11 per cent. has to be added to this cost, as shown in the reduction table. This gives the cost of coal per kilowatt hour .63 cent, as against .33 for the condensing engine.

There remains to be included in the operating expenses for this station water, oil, small supplies, repairs, superintendence and general expense, which I have estimated at .093 cent per kilowatt hour. The total operating expense foots up to .58 cent, which, added to the fixed charge of .4 cent, makes the total cost power for standard .98 cent, or very nearly 1 cent per kilowatt hour.

Before comparing the costs from the various steam plants I will review briefly the circumstances governing the production of power by water.

The application of water power to street railways has the following points of advantage: In plants operated under any but very low heads the generating machinery may be installed at a less cost than for steam. Also, the fuel expense disappears as well as a portion of the cost of repairs. A part of the labor expense will be saved inasmuch as no engineers, firemen or coal handlers are required.

The cost to produce power from water is often compared with the cost to produce from coal on the basis of continuous operation for twenty-four hours a day. For street railway service this method gives a false impression, since it implies that the machinery is working at its full capacity for 8,760 hours per annum or 100 per cent. load factor; as a matter of fact for street railroad service a load factor of 33 per cent. is high. For street railway service, on the other hand, there has to be installed sufficient generating machinery to take the peak of the load. This is usually three times the average and is only of a few hours' duration each day.

Water power produced in various parts of the country varies greatly in its cost. It is reported that the electrical energy so produced costs from $14 to $32 per annum per kilowatt continuous output. This expense is largely made up of fixed charges, which increase rapidly as the expense of making the necessary improvements is greater. The standard steam plant produces power with $3 coal for $29, and with 80-cent coal for $22 per kilowatt per annum, which compare very favorably with the above for water power.

A disadvantage occurring in the use of water power is that in some cases on account of certain periods of low water an auxiliary steam plant has to be kept in reserve, which is, of course, an additional expense. There can be no general rule given that will determine whether it is more advantageous to use water or steam power. Each case must be figured by a competent engineer and decided on its merits. The great majority of street railways being operated by steam, I shall not dwell longer on water power, as there is still considerable ground to be covered in the consideration of the steam stations. I have compiled and classified the data on representative ones throughout the country. Tables I. and II. give the results.

The general arrangement of the tables is as follows. Each vertical column contains the data for a different station during a stated period. Each station is represented by a number which appears at the head of the column; only a portion of the table is exhibited to you on the large diagram for obvious reasons, but I will describe the different items as they appear in the completed table. The first column is headed S. for "standard station." Following down the column first, comes the capacity expressed in multiples of 1,000 k. w., 3.6 meaning 3,600 k. w. The number of units of engines, 3; ditto for generators, 3; number of units engine per 1,000 k. w. capacity is .83, obtained by dividing 3 by 3.6; ditto for generators, .83. The next line under "type" is a description as to whether the engines are belted or direct connected to the generators; "B" for the former and "D. C." for the latter. The two lines marked S. C. T. and N. or C. refer to engines, simple compound or triple, non-condensing or condensing, as in standard C is compound condensing.

The period during which the averages are taken is given in days. Load factor is in per cent. Inserted in the proper place under costs are the per cent. S and per cent. total, which figures represent the per cents. the items bear to the corresponding ones for standard, and to the total operating expenses respectively.

The number of shifts, duration in hours and shift hours, together with the rate of pay of men in cents per hour and number of men per shift per 1,000 k. w. capacity complete the data necessary for the analysis of the cost of labor. Costs are all expressed in cents per kilowatt hour. Opposite fuel are given pounds of coal per kilowatt hour, and price, which is in dollars per short ton, which give the necessary figures to analyze the cost of fuel per kilowatt hour. Kind, A. or B. refers to anthracite or bituminous.

Repairs, supplies other than coal; that is, water, oil, waste, lamps and miscellaneous, as well as superintendence and general expenses, are treated as one item hereafter called general expense.

As a supplement to the tables, in order to more clearly illustrate the relation of the costs, I have constructed diagrams in which these are represented by different shadings.

It will be noticed that these shaded lines are of various heights, their height corresponding to the cost of the power in cents per kilowatt hour. Four kinds of shading are used: horizontal, equaling general expenses; vertical, cost of coal, and diagonal, cost of labor. These, which are operating expenses, are laid out above the line, and black, equaling fixed charges, is plotted below the line. The distance from the base line O up to 1 represents 1 cent, and the magnitude of each item is denoted by the length of its shading. The diagram for table No. 1 is laid out in six groups, one group for each station. The first, or left-hand column, in each group represents the costs for the standard station. You will notice that its total length, including the solid black, is about equal to the distance between 0 and 1, so that, including fixed charges the cost of power per kilowatt hour per annum for the standard station amounts to about 1 cent. It

Digitized by Google

also appears that the fixed charges are approximately equal to the coal. Labor is roughly about half the coal and general expense about half the labor. These proportions are simple and easily remembered and we might expect them to hold approximately for stations under similar governing conditions.

I shall next call to your attention station No. 3, whose equipment differs from the standard as follows: It has two units instead of three. Each generator is 800 k. w., making a capacity of about half that of the standard. The generators and engines are direct connected, the latter being compound condensing—smaller, of course, than the standard, but in other respects similar. Three 500 h. p. water tube boilers, economizers and heaters complete the important part of its equipment.

Shade group No. 3 indicates the cost of power for this station. At the extreme left is the standard. The next column shows cost per kilowatt hour averaged for one year. At the extreme right of the group is the average for a light month, and at the left of this is the month of high output. It is to be noticed that the total cost of operation for the year is somewhat greater than standard. Coal expense practically the same; labor and general expense somewhat higher. Coal expense being the same, does not in this instance indicate that the economy of the station is as good, as, by referring to the table, it will be seen that the pounds of coal per kilowatt hour is 2.61, as against 2.2 for standard. This increase is, however, nearly balanced by the reduction in the price per ton, which was $2.60, as against $3 for standard.

It might be expected that on account of the diminished size of the station the labor expense would be larger on account of requiring more men per 1,000 k. w. An examination of the table shows in fact that the men per 1,000 k. w. is nearly double what is required for standard. This would double the labor expense, providing the rate of pay and load factor remained the same, but by a coincidence the rate of pay is lower and the load factor enough higher to bring the labor expense down to nearly standard figures.

To illustrate the effect of a high load factor in reducing the cost of labor per kilowatt hour, it will be interesting to look at the next shaded column for this station, which represents the cost during January. In this month the load factor was 59, as against 46 for the year, and it will be noticed that the labor is reduced to less than the standard. The reduction in the total cost for this month, as against the yearly, is also apparent, and this is due principally to the reduction in labor.

It will be seen that the coal expense is but slightly less and seems not to be much reduced by the increased load factor. The explanation of this lies in the fact that the station is tied in with others, which keeps its load from fluctuating even on the low load factor. This will be still further exemplified by referring to a light month; the column at the right of the group gives the costs for September, during which the load factor was .43, as against .59 for January. The coal expense is still further diminished, and by reference to the table will be found to be due to an increase in the efficiency of the station. This might be found to be on account of not having to force the boilers. The increase of labor due to the low load factor is to be noticed.

I wish to say at this point that it is impossible for me in the limited time to give more than a general idea of the large number of interesting facts which may be obtained by careful study of the tables.

Plant No. 2 is somewhat larger than the last and is equipped with two 1,000 k. w. generators direct connected to compound condensing engines. It has also economizers and heaters. Its costs are in column No. 2. In looking at the yearly average it will be noticed that the total costs rise above the standard and are due to an increase in labor and general expense. Coal, as before, is the same, the decreased efficiency being balanced by the lower price per ton. Examining the table with a view to accounting for the increase of labor, we find the load factor approximately the same as standard, but an increase in the number of men per 1,000 k. w. This is accounted for by the smaller size of the station. General expense is greater, as would be expected. A glance at the shaded diagram representing the heavy month for this station gives a nice illustration of the effect of the high load factor, which is 51 as against 33 for the year. It is to be noticed that the coal is practically the same, the reduction coming in the other two items. This brings the total cost for the month below standard. In the light month, with a low load factor of 28 per cent., the labor increase is very apparent.

I shall now present the costs of operation of a large station. Its equipment consists of six 1,200 k. w. generators direct connected to triple condensing engines, two 1,500 k. w. generators direct connected to compound condensing engines, and an auxiliary plant of forty 62 k. w. generators belted to compound non-condensing engines and only used in case of emergency. Economizers, heaters and electric feed pumps complete the important part of the equipment.

Shaded group No. 4 indicates the costs for this station. The yearly average shows that we are approaching standard figures in labor. This item is not much less, as the units are only slightly greater capacity. Load factor, rate of pay and men per 1,000 k. w. correspond very closely with standard. The general expense and coal bring the total somewhat higher. General expense is high on account of the heavy repair account. The station is about eight years old and repairs are heavy, due to replacing worn-out parts. The decrease in efficiency, as shown by pounds of coal per kilowatt hour, might be shown by a test of be due to old boilers.

The plants just considered have all been direct connected. Station No. 5 is a belted plant a little more than one-half the capacity of the standard, equipped with seven 340 k. w. generators belted to a countershaft, to which are belted three triple condensing engines. The auxiliary apparatus affecting the economy of the station are economizers and feed water heaters. Shaded diagram No. 5 represents the costs of a year and also for the heavy and light months. During the three periods the coal expense remains about the same, but there is considerable variation in the other items, due principally to the change of load factor.

Notwithstanding the high load factor, 52 per cent., the labor for the year is still above standard. This would be expected from the multiplicity of parts to look after in a belted countershaft station. The reduction of general expense and labor in the heavy month is due to the load factor of 64 per cent.

Diagram No. 6 represents the costs for a belted plant of about one-fifth the capacity of standard. Its equipment is twelve gen-

No. of Station.	8	10	11	12	13	14	15	16	17	18	19	23	25
Cap. in 1,000 k. w.	2.6	.4	1.4	1.0	2.0	1.6	1.6	1.0	.8	.4	3.0	.8	4.0
Type. Units E	3	3	3	3	4	4	10	3	2	3	6	3	10
Type. Units G	3	3	3	7	4	4	16	6	4	3	6	3	19
Type. B. or D. C.	D.C.	D.C.	B.	B.	D.C.	B. D.C.	B.	B.	B.	B.	D.C.	B.	B.
Type. S. C. T.	C.	S.	S.	C.	S.	S.C.	S. C.	C.	C.	S.	....	C.	S.
Type. N. or C.	C.	N.	N.	C.	N.	N.C.	N.C.	C.	C.	N.	....	C.	N.
Period—Days	365	1	365	365	365	365	180	365	365	365	31	182	365
Load Factor—Per Cent	38½	34	33	35	42	19	41	33	24	....	....	16	33
Taken from Car-miles	....	....	*	....	....	....	....	....	*	....	....	*	....
Labor. Shifts	3	....	2	2	2	2	2	3	2	2	2	2	2
Labor. Duration	8	....	12	12	12	12	12	8	12	12	12	12	12
Labor. Shift-hours	8,760	....	8,760	8,760	8,760	8,760	4,390	8,760	8,760	8,760	744	4,380	8,760
Labor. Men per 1,000 k. w.	1.94	7.5	3.7	3.7	3.0	1.87	6.3	27	3.7	3.7	8.0	4.3	....
Labor. Rate of Pay	27	18	20	20	23	15	16	20	16	12	17	25	....
Labor. Cts. per k. w. Hr.	.107	....	.38	.21	.16	....	.38	.33	.38	....	....	.51	....
Fuel. Lbs. per k. w. Hr.	2.2	....	6.7	4.8	6.5	....	6.5	6	5	....	....	6	5.6
Fuel. Price ($) per Ton	3	2	2.24	2.06	1.44	....	2.10	2.30	1.43	.75	.09	2.44	1.05
Fuel. Kind—A. or B.	B.	.5 A. .5 B.	A.	B.	B.	....	B.	B.	B.	B.	....	B.	....
Fuel. Cts. per k. w. Hr	.80	....	.75	.68	.47	....	.68	.68	.36	....	....	1.08	.28
Gen. Ex.—Per k. w. Hr.	.080	....	.08	.11	.09	....	.14	.09	.08	....	....	.16	....
Total Op.—Per k. w. Hr.	.88	1.5	1.4	1.05	.72	....	1.07	1.15	.70	....	.66	1.7	.86
Fixed Charges	.455	....	....	.44	.34	....	.34	....	....	....	....	1.	....

No. of Station.	26	28	29	30	31	32	33	34	35	37	40	42	43	44	45	47	48	50
Cap. in 1,000 k. w.	.8	1.4	1.9	1.7	.9	5.3	1.5	2.0	1.2	1.5	9.2	1.8	2.3	6.0	1.6	.35	.8	....
Type. Units E	7	4	5	5	6	5	4	4	1	3	6	3	5	6	4	4	2	....
Type. Units G	12	6	5	5	3	20	12	4	1	11	6	6	10	12	7	4	2	....
Type. B. or D. C.	B.	B.	B.	B.	B.	B.	B. D.C.	D.C.	D.C.	B.	D.C.	B.	B. D.C.	B.	B. D.C.	D.C.	D.C.	....
Type. S. C. T.	S.	S	C.	C.	C.	C.	C.	C.	C.	C.S.	C.	C.	C.	C.	C.	C.	C.	....
Type. N. or C.	N.	C.	C.	C.	C.	C.	C.	C.	C.	C.N.	C.	N.	C.	C.	C.	C.	C.	....
Period—Days	365	31	365	365	365	365	365	183	365	181	365	365	365	365	30	183	365	....
Load Factor—Per Cent	19	28	37	25	32	31	16	57	27	11	36	46	15	30	38	30	18	....
Taken from Car-miles	....	....	....	....	....	....	....	....	....	....	....	....	....	....	*	*	....	....
Labor. Shifts	2	2	3	2	3	2	3	3	2	3	3	3	2	3	2	2	2	....
Labor. Duration	12	12	10	10	10	12	12	12	12	12	8	8	12	8	10	12	10	....
Labor. Shift-hours	8,760	744	7,300	7,300	7,300	8,760	8,760	4,392	8,760	3,604	8,760	8,760	8,760	8,760	600	4,380	7,300	....
Labor. Men per 1,000 k. w.	....	5.0	3.3	5.0	4.5	3.5	5.0	6.0	3.1	3.0	2.7	3.6	3.7	3.3	3.0	6.0	4.7	....
Labor. Rate of Pay	....	17	21	21	21	20	20	20	20	16	20	20	16	24	15	22	16	....
Labor. Cts. per k. w. Hr.	....	.37	.25	.27	.20	.28	.08	.18	.15	1.1	.17	.28	.20	.28	.10	.42	.20	....
Fuel. Lbs. per k. w. Hr.	8.8	7	3.9	3.3	4.4	3.5	4.3	3.3	4.7	7.3	3	5.7	2.7	3.5	4.7	5.1	3.3	....
Fuel. Price ($) per Ton	1.15	1.03	2.60	3	2.34	3	2.08	1.0	1.24	1.75	1.30	1.00	2.70	1.00	1.30	2.19	3.75	....
Fuel. Kind—A. or B.	....	....	....	B.	B.	B.	B.	B.	B.	.5 A. .5 B.	A.	A.	.6 B. .4 A.	A.	B.	.5 A. .5 B.	B.	....
Fuel. Cts. per k. w. Hr	.30	.87	.85	.43	.88	.38	.86	.37	.38	.66	.24	.45	.30	.30	.45	.34	.45	....
Gen. Ex.—Per k. w. Hr.	....	.08	.33	.18	.19	.09	.22	.12	.04	.13	.11	.18	.14	.18	.08	.21	.20	....
Total Op.—Per k. w. Hr.	1.2	1.08	1.08	.81	1.1	.84	1.5	.87	.48	1.35	.08	.89	1.08	.80	.88	1.16	1.00	....
Fixed Charges	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

TABLE II.—DATA ON OPERATION OF RAILWAY POWER STATIONS.

Digitized by Google

erators belted to four simple high-speed non-condensing engines. There are feed water heaters but no economizer. High coal consumption is the feature of this diagram, the cost of fuel alone for the year being equal to the total operating expense for standard. Labor is also high, and the total cost of power per kilowatt hour is nearly double the operating expense of standard. This station furnished a good illustration of the effect on the cost of power of a simple non-condensing belted equipment. It is to be remarked also that this plant has the benefit of a high load factor.

It will now be interesting to turn our attention to a small direct connected station which is numbered 1. This operates about thirty cars. It is equipped with three 200 k. w. generators, has compound condensing engines, heaters but no economizers. It does not feed in with other stations, as do those which have been previously mentioned and has a very fluctuating load, as may be imagined in the operation of so small a number of cars. This station is just one-sixth the size of the standard, and it will be noticed that the column representing its operating expenses is about twice as high. The great increase is in the labor, although the station is operated by a corporation which has had a vast amount of experience in railroad work. Can we account for this increase in labor? By referring to the table, we find

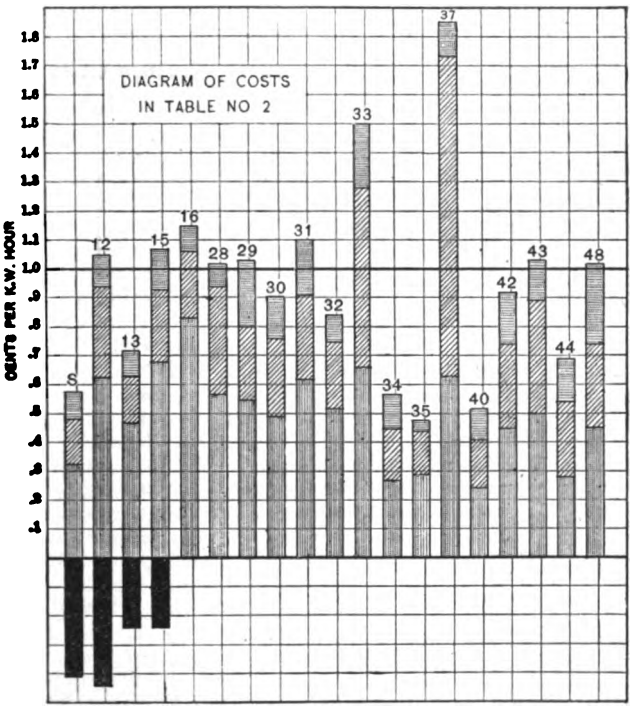


DIAGRAM OF COSTS IN TABLE No. 2.

the rate of pay of men is practically the same as standard, the load factor is low—22 per cent., as against 33.

Referring to the heavy month for this station, which has the benefit of a 30 per cent. load factor, we find that the labor is reduced, but it is still a long way from bedrock figures. The examination of the table discloses the fact that the increase comes in the men per 1,000 kilowatt, being about 2.5 times the standard figure. The secret for the large number of men per 1,000 k. w. lies in the small number of kilowatt capacity. These same men could look after a station of greater capacity.

I shall next give the costs on plant No. 12, whose figures are presented in table No. 2. This plant is about one-third the size of standard. It does not feed in with other stations. Its generators are belted to three tandem compound condensing engines which operate under steam pressure of 110 pounds. It has water tube boilers averaging four years of service; heaters, but no economizers. A good quality of bituminous coal is used, which costs $2.93 per ton. By reference to the table it will be seen that this station produced power to the extent of 23 per cent. of its capacity during the past year at 1.49 cents per kilowatt hour, including fixed charges, the operating expenses alone amounting to a little over 1 cent. The total cost of operation for the year was $23,000, of which $13,610 was for coal. Water costs this station nothing and the labor was about one-half the coal bill. By referring to the shaded diagram No. 12 it will be seen that the coal and labor are both much higher than standard, and if standard performance had been reached a saving of $10,000 would have been made in the operating expenses for the year. An analysis of the items is given in column No. 12 of the table, and by comparing with standard the differences may be readily seen. I do not wish to be understood in making these comparisons that it would necessarily pay to make the changes required to effect this saving, my present idea being to bring clearly before you the differences.

Station No. 13 is an interesting combination of cheap coal, simple non-condensing engines direct connected to the generators, together with a high load factor. Its capacity is 70 per cent of the standard, the major part being three 800 k. w. generators; the smaller unit is 200 k. w. It produced power to the extent of 42 per cent. of its capacity at .96 cents per kilowatt hour, inclusive of depreciation and fixed charges. The depreciation is charged in at 5 per cent. on a capital expenditure of about $60 per kilowatt. The total expense for the year was $92,617.28, which is made up of

Labor	$15,453.25
Repairs and renewal of steam plant	1,839.69
Repairs and renewal of electrical plant	56.71
Fuel	44,780.94
Water	4,405.40
Oil, waste and lubricants	1,881.53
Tools, appliances and supplies	634.23
Taxes	1,945.65
Insurance	2,146.94
Interest	11,472.94
Depreciation 5 per cent. on $160,000	8,000.00
Total	$92,617.28

The analysis of these items is given for comparison with standard in column No. 13 of table No. 2. The shaded diagram shows labor for this station to be equal to standard, principally on account of high load factor; the other differences are also apparent. It is interesting to note that the road operated by this power station used on an average of about 1.3 k. w. hours per car mile. Total car miles for the year was 7,207,308, about 10 per cent. of this mileage being trail cars. There is other interesting data about this road which time will not permit me to review.

Plant No. 15 is an interesting example of what a multiplicity of units will do for labor, the figure being 6.3 men per 1,000 k. w. The effect of this would be much more apparent on the color diagram were it not for the high load factor and low rate of pay.

Plant No. 16 is of 600 k. w. capacity. The cost of power for the past year was $53,000. Load factor is the same as standard. Standard operates to produce about double the output for the same figure.

Station No. 28 is 1,400 kilowatts capacity, has slow speed condensing engines, heaters and economizers. The feed water leaves economizer at the high temperature of 258 degrees. The engines are simple belted to the generators and coal costs but $1.63 per ton.

Plant No. 29 is a compound condensing slow speed belted station of 1,900 k. w. capacity and feeds in with another station. The coal costs $3.86. Plants 30 and 31 are operated by the same corporation as No. 29.

No. 32 is a combination of two power houses feeding into the same system. These stations are interesting because these costs are for the past year, and since then these two stations, as well as smaller ones operated by the same company, have been consolidated into a large water power plant, from which power is transmitted at 13,000 volts. The two steam stations shown in column 32 have five triple expansion condensing engines. This road operated on about 1.4 k. w. hours per car mile. The coal costs $3 per ton. The water power plant which replaced the steam has not been in operation long enough to enable its costs to be given.

Station No. 33 has rather a tall column, due principally to its low load factor of 16 per cent. Station No. 34, operated at a lower cost than standard on account of the high load factor, 57 per cent., reducing the cost of labor and low price of coal $1 per ton.

No. 35 is a plant of 1,200 k. w. capacity, interesting on account of the fact that it has but one unit. It operates with 2.1 men

Digitized by Google

per 1,000 k. w., a load factor of 37 per cent., coal costing $1.24 per ton. Its costs are quite a little lower than standard.

No. 37 is a record-breaker in the opposite sense. It is of slightly greater capacity than 35, but has three engines and eleven generators, which require eight men per 1,000 k. w. capacity. It has a load factor of but 11 per cent. during 151 days, from January 1 to May 31, 1898. The effect of this on the cost of labor is very apparent.

No. 40 has a capacity of 9,200 k. w. It is direct connected, has economizers and compound condensing engines. Anthracite coal is burned, costing $1.60 per ton. This plant operates at less than standard figures.

No. 42 is a belted plant, compound non-condensing engines, heaters, but no economizers. It has a good load factor, but the effect of the belted and small units shows in all three items.

No. 43 is a combination of alternating and direct current apparatus. It has a low load factor of 15 per cent., the effect of which is noticed on the labor.

No. 44 is a 6,000 k. w. station, and, although belted, has large compound condensing engines and economizers, which, with coal at $1.60, brings the cost of fuel below standard figures.

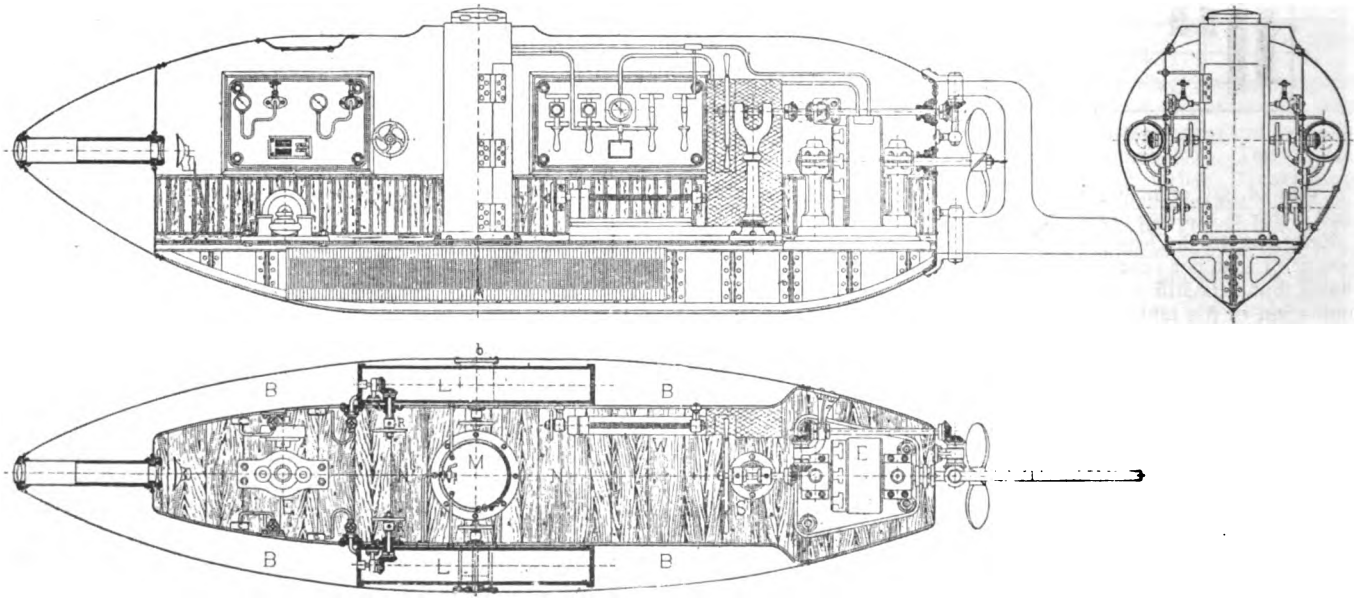
It will now be instructive to take a general survey of the shaded diagram for all stations in table No. 2. No. 37 towers above all the rest. Standard is at the extreme left. Coal in No. 37 is greater than the total operating expense for standard. This station pays but $1.75 per ton, but it uses 7.3 pounds per kilowatt hour. Compare this with No. 35, about the same size plant, paying $1.24 for coal, and using but 4.7 pounds per kilowatt hour.

I can hardly ask you to compare the labor, but it is easily seven times as large in 37 as in 35. The load factor of 11 per cent., as against 37 per cent., would make this item three times as great, and men per 1,000 k. w., 8, as against 2.1, would again increase the cost of labor three times. The higher rate of pay in plant No. 35 prevents the discrepancy being greater. Let us look along the line for high coal cost. No. 16 seems to bear off the palm in this respect; $3.50 per ton and 5 pounds per kilowatt hour accounts for this. For strikingly low costs we have No. 34, 35 and 40.

Submarine-Accumulator Boat, Sandor Bak-Budapest.

THE accompanying illustration shows a new submarine boat used for the purpose of laying submarine mines, launching torpedoes and for any kind of submarine work. The body of the boat consists of two airtight compartments separated from each other. The inner space N is reserved for the crew and the installation of the machinery and auxiliary apparatus. The outer space BB forms a space in which the two air accumulators LL are placed. In the under portion A of the body of the ship the electrical accumulators are situated, furnishing current to the electric motor E. This motor is direct connected to a propeller screw, with four plates, and its speed is regulated by means of the regulator W. In order to determine the depth of the boat below the surface of the water manometers are placed in the fore part of the boat, and these register the height of the exterior column of water. At the same time one of these instruments indicates the amount of the air pressure in the accumulators.

If the outer space B of the body of the ship is filled with air, then the boat floats on the surface of the water and the manhole, situated at the upper portion, is above the surface of the water. If it is desired to lower the boat, water is admitted into the spaces B B by means of the slide b, and the air is removed. In order to ascend, the air accumulators L L, in which air at a pressure of 100 atmospheres is stored, forces the water out of the spaces B B and thus lighten the boat. In consequence of this reduction in weight the boat again rises. The rapidity of this operation is regulated by means of the ventilator R. All requisites for a diver are contained in the boat, so that he can do his work under water. He can also leave the boat under water by entering the cylinder M, closing the slide door which leads to the inner portion of the boat, forcing out the air in the space M by means of water and then stepping out of the manhole above. The entrance to the boat is accomplished in a similar manner. The small electric motor E serves to drive a compresser which is used for the filling of the air accumulators. We are indebted to the Electrotechnische Anzeiger for the above details and accompanying illustrations.



SUBMARINE-ACCUMULATOR BOAT, SANDOR BAK-BUDAPEST.

The New York Central and Its Competitor "The Trolley."

BY ORRIN E. DUNLAP.

THE first recognition that the New York Central & Hudson River Railroad has given to the competition it has experienced from the electric railways between Buffalo and Niagara Falls and between Buffalo and Lockport has just been made in a general reduction of rates on the part of the New York Central from Buffalo to the points on the competing lines. The new schedule of rates went into effect Saturday morning, September 3, and are as follows:

	One way.	Round trip.
Between Buffalo and Tonawanda	$0.20	$0.30
Between Buffalo and Niagara Falls	.40	.50
Between Buffalo and Suspension Bridge	.45	.60
Between Buffalo and Lewiston	.60	.75
Between Buffalo and Lockport	.50	.75
Between Tonawanda and the Falls	.25	.40
Between Tonawanda and the Bridge	.30	.50
Between Tonawanda and Lewiston	.45	.60
Between Tonawanda and Lockport	.30	.50

On Saturdays and Sundays the round trip rate between Buffalo and Lockport will be reduced to 50 cents. So far the fight between the steam road and the electric roads has not yet reached the stage of a rate war, the intention of the Central

Digitized by Google

being to lower the fare over its line so as to about equal the fare on the electric cars. In the future the fare from Buffalo to the Falls will be 50 cents, while in the past it has been $1. There has been a special rate of 50 cents for parties of five or more, but the trouble has been to organize these parties. The reduction of the rate between Buffalo and the Falls is the most important feature of the new schedule, owing to the enormous traffic between these points. Heretofore the fare over the Central from Buffalo to Lockport was $1, and this also has now been cut in two. In just one instance does the cut of the Central drop below the price on electric cars, and this is between Buffalo and Lewiston. The round trip fare between these points has been $1.55 on the Central. Now it is 75 cents, or 25 cents lower than the rate charged by the Buffalo & Niagara Falls road. Formerly the round trip fare over the Central between Buffalo and Tonawanda was 44 cents, and this has been reduced to 30 cents.

Of course, the action of the New York Central is intended as a bid for traffic now going over the electric lines, but just what the effect will be, so far as the trolleys are concerned, remains to be seen. The time occupied by the Central in making the trip from the Falls to Buffalo is from 50 to 60 minutes, while the electric line takes nearly an hour and a half for the run. This time feature is an important item, and especially will it be such in Winter. The cars of the New York Central are always nice and warm, whereas it is hardly possible to get the same degree of comfort on a trolley car. In passing through Tonawanda the electric cars lose time, not only on account of a limitation of speed, but also because their route is indirect. Should this be remedied they would be in better condition to compete with the Central. It is considered highly probable that the Buffalo & Niagara Falls Company and the Buffalo & Lockport Railway Company will take some action to offset the effect of the cut, but what this will be remains to be seen. A very lively rate war may result. The effect of this would be noticed more in the vicinity of the Falls and Buffalo should it occur during the busy summer season. As it is now, the season in the Niagara locality is drawing to a close for this year with each passing week.

When one considers the careful manner in which the great New York Central proceeds to do a thing, it will be recognized that the adoption of these schedules is the most important step yet taken in any locality by a steam railroad to fight the trolley lines. It is a well-known fact that the effect of the competition between steam and electric lines has not been felt in the Niagara locality alone, but so far as known the New York Central is the first steam road to reduce passenger rates to the level of those on competing trolley lines. Another feature is the fact that the electric railway companies have been able to offer special inducements to the traveling public, which the steam roads have found it difficult or impossible to meet, the result being that the electric roads have caught the travel. The New York Central's summer train service from Buffalo to the Falls consists of 16 trains, and 17 trains from the Falls to Buffalo. If traffic warrants it, they announce that they will put on more trains.

As the New York Central has undoubtedly a well laid plan in what it has started out to do, it will be well worth watching developments in the competition for the passenger traffic to and from Niagara Falls.

Points in Track Construction.

IN speaking of the subject of track construction before the New York State Street Railway Association, Mr. D. F. Carver, of the track department of the Brooklyn Heights Railroad, said:

"As the lightest section of 9-inch rail is more than amply strong to stand the strain of carriage, provided, of course, that every tie has a first-class bearing, it has been found desirable to roll the web down to the thinnest section possible and accept the small losses due to rails splitting along the web from the tension caused by the very unequal distribution of metal. The breakage above referred to has been found to be, throughout a year's work, about one-fourth of 1 per cent. of rail laid.

"The problem of the rail joint has been a very trying one, but it is fast approaching a successful and satisfactory solution, the essential features of which are either a welded joint, which makes a rail practically one continuous mass, or the mechanical joint, which avails of the bearing surfaces beneath the head and tram, and beneath the base, and of the upper surface of the base of the rails which it connects. Either joint to be entirely successful, however, must be laid with tight joints, so that passing wheels will have a continuous bearing.

"This method of construction will, in time, force the track out of line, and where the line is curved to any extent will push the curve out of line, and also in renewing any portion of the track in warm weather it will be found almost invariably impossible to put in new pieces of the same size as the old removed, because the great compression strain closes up the opening. Still, with all these objections, the added length of life of joints gained is of decided advantage.

"With the girder rail sections, in block-paved streets, it is absolutely necessary to use a rail filler. We have experimented with a burnt brick, which was found to crumble badly under heavy wagon traffic, and it has been abandoned. In its place are used hemlock planks, which give the best results on the investment.

"In paving up the street the portions outside the outside rail and between the tracks should be paved and thoroughly rammed before the sections between the rails are paved. This prevents the crowning of the stones between rails from forcing the track out of gauge. A bed of concrete between ties has been tried to prevent the paving blocks from sinking, but experience with this construction has not been very satisfactory, and as its first cost is great and also as the interest on this extra investment is, in many cases, greatly in excess of the maintenance charges which it is intended to prevent, he is led to doubt very greatly its utility."

PRACTICAL RADIOGRAPHY. By A. W. Isenthal and H. Snowden Ward. London, 1898. The Photogram, Ltd. Brooklyn, N. Y., B. Harrison & Co. 157 pages, 5½x 8½ inches, 51 illustrations and 16 plates. Cloth.

The volume is a second edition, or rather, a revised, enlarged and rewritten arrangement of the first edition by H. S. Ward, of the Photogram, 1896. The book is of handy size, written in good terse style and contains all of the principal advancements made in X-ray work, especially that of European experimenters. It is in this respect a valuable reference book. Its chapters on applied medical and surgical radiography, covering only 22 pages, will hardly afford more than a superficial knowledge to the radiographer and physician. The half-tone illustrations are exceedingly fine; in this the authors have been favored by such men as Drs. Macintyre, Davidson, Hall Edwards, W. A. Caldwell and the Voltohm Company, of Munich. F. S. K.

CAMP WIKOFF, at Montauk Point, Long Island, has an electric light plant that is of great service. It has a Westinghouse arc dynamo driven by Westinghouse engine, and has been set up under the direction of Capt. Higgins, of the Signal Corps. Roads, hospitals and various headquarters are lit up.

THE LIMA-HONEOYE ELECTRIC LIGHT COMPANY OF HONEOYE FALLS, N. Y., has been formed with a capital of $125,000. They are putting up a brick power house with slate roof, iron trusses, maplewood floor and stringers, embodied in concrete. Within this station they are installing two Otto gas engines of 136 horse power capacity, and one of 75 horse power, and two 90 k. w. Warren-Medbery alternators and one 150 k. w. Walker railway generator. This latter is for the purpose of furnishing current to the Lima railway which will be absorbed by the company as soon as they are ready to furnish light. They have also installed Westinghouse and General Electric 60 cycle transformers, and the voltage of their lamps will be 115. They will string twenty-one miles of No. 6 copper wire and the voltage at the station will be 2,200. The officers of the company are: Wm. C. Warren, president; Albert L. Williams, vice-president and general manager; Peter P. Miller, secretary and treasurer; H. H. Littell, Henry W. Bot, Jno. C. Conway, A. M. Holden, of Honeoye Falls; E. D. Watkind, of Lima; Chas. R. Huntley, directors; all of Buffalo, except as noted.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1888.*]

Vol. XXVI. NEW YORK, SEPTEMBER 29, 1898. No. 543.

The Recent Electric Lighting Consolidation in Chicago.

ONE of the most notable events of the past summer in electric lighting was the consolidation of a number of the local companies at Chicago. They were not absorbed by the local Edison Company, but were gathered up by the Commonwealth Company, whose officers are the same as those of the Edison, so that a practical harmony and identity of interests is secured. But for the occurrence of this financial event at a time of fervent summer heat, it would undoubtedly have attracted more attention then, and now, only a month later, it may be noted as perhaps the most important operation in the field of local electrical illuminating finance since the panic of 1893, while prior to that time few operations could compare with it.

What we have to consider in this deal is not the obliteration by purchase of a number of competitors, but the organization into one protective bulwark of several concerns that had begun to grow up by the natural course of things in the fast-spreading suburbs of the Western metropolis. This problem of securing the territory beyond a company's immediate sphere of legitimate operation is one that managers have to face frequently in our new American cities. If it is flinched from, the consequences of irresolution are often grave, and sometimes the "rank outsider," by steady, persistent encroachment, becomes the monopolizing insider, eating up the conservative company that had allowed itself to be surrounded by hostile lines through which it could never break. In the present case those who are familiar with the intelligent aggressiveness of President Insull and his associates were not surprised to find that they took the proper steps with judicious boldness and made themselves masters of the situation. The new Commonwealth Company has welded together no fewer than nine companies on the South, West and North Sides, as we noted at the time, and as it enjoys comprehensive rights and franchises for fifty years, its ability to reinforce the central Edison company is obvious, not draining it as a sucker, but, as a feeder, ensuring a growth in keeping with the expansion of the population and wealth of the city.

Such a transaction is not to be judged, indeed, by its immediate financial aspects and results. The considerations are often strategic, as intimated. It would seem that the issue of $2,150,000 5 per cent. forty-five year bonds is a moderate insurance for the future and continued superiority of the Edison interests in Chicago, but the deal carries with it a prompt justification. The earnings of the consolidated companies, each standing alone and in the unproductive summer season, showed a net more than sufficient to take care of the interest charges of about $110,000 on the bonds issued. Our own opinion is that with administrative economies and ordinary income, from existing plants, there should be a heavy surplus of not less than $50,000 a year. The bonds are guaranteed by the Chicago Edison Company, which itself earned last year more than 9 per cent. above its fixed charges, but the real inwardness of the possibilities was seen in the advance of Edison stock to 150, and since then we believe it has been quoted much higher. The total capital stock of $5,000,000 of the Commonwealth Company will be held in the interest of the Edison shareholders, and there are various features which will tend to unify the workings of the two systems, even though the law of the State operates against a general merger of all the interests concerned. Moreover, the Commonwealth Company has secured additional ordinances from other outlying local companies, under which it can put plants in operation, but in view of the long distance distribution now carried on successfully, the generation of current may be closely centralized, and the present operating expenses in scattered stations deeply cut, with corresponding gain in net revenue.

We have emphasized this recent event, not only because of its own interest, but because of the bearing it has necessarily on the situation in other large cities and the light that throws on present tendencies. It means concentrated management, of course, but it also means very large station units, phase transmissions, distribution from rotaries, storage equipments and other features of operation not within the survey of even the most far sighted when the central station art was founded.

What Becomes of Our College Graduates?

EVER and anon we hear the remark that the profession of electrical engineering is getting to be overcrowded, like those of law and medicine, and a wail goes up that our engineering colleges are turning out electrical engineers who become a drug in the market. We have more than once had occasion to refute this error and we recur to the subject again only because as time passes additional evidence accumulates to prove that the trained electrical engineer, far from being relegated to enforced idleness, is sought after and finds lucrative employment. How else indeed would it be possible to operate the hundreds of large electric plants of all kinds installed in the past or the numberless others to be erected in the future? But, leaving speculation aside, we need only glance over an interesting circular just issued by Prof. D. C. Jackson, of the University of Wisconsin, showing the record of every graduate of the department of electrical engineering since its inauguration six years ago. An analysis of the list shows that over 20 per cent. of the first five classes that graduated from the course have already become managers, chief engineers or superintendents in important industrial enterprises. We admit that we have no comparative statistics to go by, but we would be exceedingly interested to learn that so high a percentage of the graduates in any other profession had attained positions of similar responsibility in so short a time. As to the others on Prof. Jackson's list, we note that approximately 15 per cent. are teachers of engineering and science. When one stops to consider how many young men enter professions for which they are unfortunately not fitted, but which fact is not discovered until after their college education has been completed, the above record is certainly striking. The list before

Digitized by Google

us shows that with few exceptions the university's electrical engineering graduates have stuck to their profession. Those who have had experience in these matters well know the significance of this. It means unquestionably two things: First, that the men have been properly equipped for their work; and secondly, that there is work for them to do. With either of these conditions lacking, the record before us could not be what it is. We have no doubt that the record of the graduates of other electrical engineering colleges is as good, and we hope they may continue to turn out young men, who alone will be able to cope successfully with the vast electrical work of the country. We feel warranted in asserting even that but for our electrical engineering colleges the new electrical work of the world could not have been accomplished for lack of competent men, and what is true of the past will be even more so as applied to the future. That this fact is recognized even by those who cannot take advantage of a university course is shown by the large number of students of all ages, and even including a number of women who have enrolled in The Electrical Engineer Institute of Correspondence Instruction. This to our mind proves the correctness of our estimate of the demand for electrical knowledge among all classes, and the many letters of appreciation of our work received from students is a sign that it is based on the right lines.

The Waste of Current.

WALKING into our office one of the cloudy days of the past wet summer, the president of a large lighting company turned off a couple of incandescent lamps with the remark that if they were gas they would not be allowed to burn, as they were not needed, having been lit earlier in the morning before the fog lifted. This incident brought up a chat on the waste of current, and all agreed that it was far more generally indulged in than sensible personal economy would warrant, especially in office buildings, where the current has already been figured into the rent and can be had at any moment by closing the switches or turning the keys. The fact that the lamps give off little heat does not make one so eager to turn them out as one is with gas, even in winter.

A striking case of this kind of extravagance to which we have all become more or less prone is mentioned by the "Philadelphia Ledger" in connection with the lighting of the City Hall. The current is supplied by the Public Buildings Commission, but this body has no control over its use in the various departments. It is not at all uncommon, the "Ledger" reports, to see the Finance Committee's room with every lamp in its starry ceiling ablaze with light and not a person in the room. The great audience room of the Mayor is not infrequently seen with its 180 lamps shedding their radiance solely for the delectation of the colored messenger, who has, perhaps, an hour before, thrown on the switch to show the room to some visitor. Room after room in which the sun's rays are so fierce as to compel the inmates to drop the window shades will have the electric lights all burning. As figured up by the "Ledger," one-third of the electric current furnished is wasted. When all the departments are in operation one-third the current produced for the six hours during which the offices are occupied daily would, at the rates paid to the electric companies, cost not less than $60 a day.

Perhaps this is an extreme case, but it is these glaring instances that help emphasize the general necessity for reform. Just how it shall be brought about we do not know. Obviously the wider use of meters would do much to check it, but the tendency in offices and apartment houses, as in hotels, appears to be to "throw in" the light, usually made on the premises. We all acquiesce in it, particularly those of us who have been swindled paying for "candles" in European hotels. In American office buildings the absence of an electric light plant is exceptional and the owners seem persuaded that they can manufacture current so cheaply as to allow their tenants to waste it indiscriminately. We imagine it to be a rare practice for the janitor of any such building to go around and see how many lights in tenants' offices can be turned off. Probably many occupants would resent his interference, although a meter would affect their attitude materially. After all, this waste must help to give a wrong idea as to the cost of electricity, for if the current were used with discretion the expenses of many thousand isolated plants for lamps and fuel would be far lower than they now are.

The Isolation of the Farm.

STATISTICS go to show that a large proportion of the insanity in this country is due to the isolation of farm life, just as no small portion is ascribed to the isolation of servants engaged in domestic employ, sitting in their lonely, bare kitchens. The farmer, however, is emerging from his loneliness and may presently be longing for it again. The trolley and the telephone have found him out, or, rather, have found him at home. He is becoming a new creature. The future is the farmer's. He has hitched his wagon to a star and his ear to the thunder, and what he now misses of the world's movement is not worth having. It is sometimes argued that so far electricity has done nothing in the domain of agriculture, whereas the truth is that even at this early period of development it has affected few branches of industry more profoundly.

Anyhow, the telephone now hangs in every farmer's hall, and, like the horn of the hunter, can be heard on every rural hill. We printed last week a characteristic statement from one of our readers who has lately been engaged in converting part of Ohio into a whispering gallery. He is not alone, however, in this enterprise. Reports of the same nature come from all over the land. Michigan is a typical example, and since one of the farmers near Grand Rapids put in an instrument and got first quotations from market his compeers all through the State have been inspired with a noble rage to patronize this improvement. We opine that their wives and daughters care less for quotations than for gossip and other humanities, and that these telephones meet many wants that are not filled by the price of bread alone. Hereafter solitary confinement on a farm ceases to be the penalty of rural life, and thus is presented another reason for expecting to see the redundant city roll back upon the country its myriads of workers, whose chief object in coming to town has been to get society.

"Science Abstracts."

THE difficulty of keeping pace with the growth of knowledge and with the record of scientific experiment, even in the lines that most interest and concern us, has long been apparent. Various ways of coping with it have been suggested, and not a few attempts of more or less excellence have been made to lessen the task of easy assimilation. At the recent meeting of the British Association Prof. W. E. Ayrton, as president of the Mathematical and Physical Section, called attention to "Science Abstracts," the object of which is to abstract all that is published of value relative to physics and its applications. The English Physical Society and the Institution of Electrical Engineers are responsible for the expenses of its publication, and already contributions in support are made by the British Association and the Institution of Civil Engineers. The corps of editors could not well be surpassed, and all who have seen the periodical must attest its remarkable utility. The firm of Spon & Chamberlain in this country represent it, and the subscription is $9 per year for twelve monthly numbers. We commend it most heartily to our readers and will be glad to receive and forward subscriptions. We would, moreover, be glad to see arrangements effected by which some of our American societies could lend a helping hand, especially the American Institute of Electrical Engineers, which once started a modest work of the same nature as a supplement to its transactions. We take this opportunity of echoing and reinforcing Prof. Ayrton's earnest appeal, and trust that Science Abstracts may not only realize its early promise, but fulfil in growing measure the great opportunities that await such a record in the English language of scientific work. Each month finds it better, more valuable and more interesting.

Digitized by Google

TELEPHONY AND TELEGRAPHY

The Fire Alarm Telegraph System of Baltimore, Md.

BY C. B. FAIRCHILD.

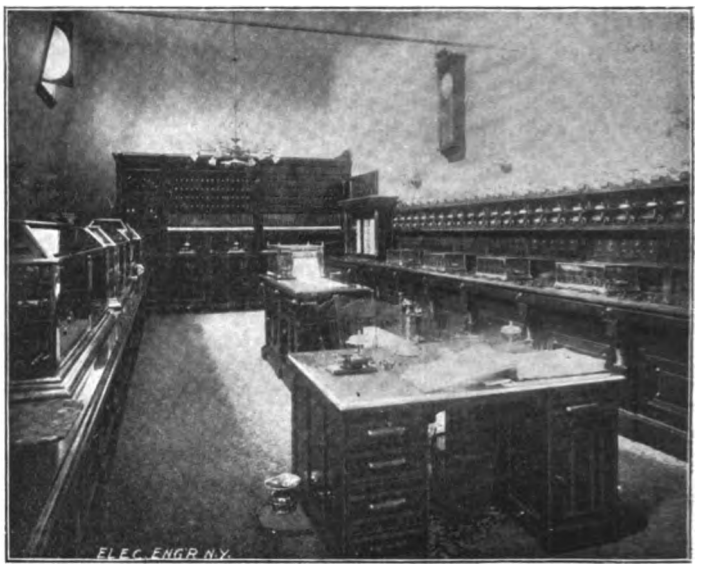
NEXT to the street railway and lighting facilities, electricity touches more people directly through its fire alarm system and telephones than in any other of its numerous uses. Not one person in any quarter of the city, no matter how obscure or feeble, whose life and interests are not more secure because of the ceaseless vigilance of this subtle agent, as it silently awaits the bid of any citizen or officer from some neighboring alarm box to spread the tidings of trouble to all the engine and truck houses of the Fire Department.

Few cities have a more thoroughly equipped, modern or better managed fire alarm signal department than Baltimore, and the credit for the same is due largely to the superintendent of this department, Mr. Leona Lemon, under whose management several recent improvements have been made. The apparatus for operating the central station and the superintendent's office are located on the fourth floor of the City Hall Building, there being two large, well lighted and tastefully furnished rooms devoted to this purpose. The first is the superintendent's private office and the second is arranged for the operators and the instruments, and between the two is a dark closet in which on two sides are arranged 96 storage battery cells of the chloride type, which furnish the current for operating signals. Until recently primary batteries of the ordinary bluestone type were employed, and of these 1,500 cells were required. By the change the superintendent estimates that a saving of $3,000 a year is effected in the expense of maintenance in favor of the storage battery, while it is more serviceable, reliable, cleanly and requires less space. The storage batteries are divided into four sections, and three sections are charged every four days from current furnished by one of the lighting companies. A marble switchboard is located against the wall in the operating room, and this is provided with voltmeters and ammeters for measuring both the incoming and the outgoing current from the batteries. There are also switches and pilot lamps that make the adjustment for charging a very simple matter. The board is divided into two sides, one for a 50-volt, the other for a 100-volt circuit, but only 50 volts are commonly employed. It takes only

BALTIMORE, MD., FIRE ALARM DEPARTMENT.

about 1-10 of an ampere to operate each circuit. Two operators on eight-hour shifts manipulate the signalling apparatus, which is arranged on two sides of the room and is known as the Gamewell system. Forty circuits connect with the engine, truck, insurance patrol and such other stations as are entitled to receive all the signals, and there are 375 fire alarm boxes to signal from which it is necessary to break a small glass plate in front of the box enclosing the key.

On entering the room the operators' desk is seen standing



BALTIMORE, MD., FIRE ALARM DEPARTMENT.

near the door and near the battery switchboard, and on the right side for the full length of the room are two banks of signal bells with switches and telegraph keys, there being a bell for each end of the circuit, all being mounted on handsomely finished cabinet counters. At the opposite end of the room is an elaborate switchboard, with plugs, drops and pilot lights, very like the boards used in telegraph offices, and so arranged that any instrument may be connected instantly with any circuit and any circuit with any instrument. On the left side of the room are three repeating instruments enclosed in glass cases, resting on a table, while an automatic registering device occupies the middle of the floor. The centre case of the repeating instruments is divided, with three dials having hands that turn like the large pointer of a clock. One of the dials indicates the unit figures, the second tens and the third, or left-hand one, the hundreds. On a signal call from any box one operator reads the call and the other adjusts the hands on the dial. If, for instance, the box call is from 329, the operator at the register calls out the first figure "Three!" the other turns the hand on the dial at the left until it points to three. "Two!" calls out the operator at the register, when the hand on the middle dial is placed at two. "Nine!" concludes the crier, and the right dial hand is pointing to that figure. Then the attendant at the dials throws a lever, and instantly the gongs in every engine house, truck and water tower, fireboat house, salvage corps, newspaper and insurance office ring out the number "329," and the whole fire-fighting brigade of the city and every person having business interests relating to fires knows in a few seconds where the trouble is located.

On receiving a signal the teams in every station are hooked up and are made ready to respond, but only those in whose district the number belongs respond to the call. Each house is provided with a register or code, so that the chief at each station knows when to respond, whether to the first, second or third call. It is a rule that where a particular apparatus of a certain district is detained at a fire for fifteen minutes some of the apparatus from a neighboring district is transferred to supply the deficiency should a second call come in. This transfer is accomplished without special orders, the arrangement being provided for in the register. When a fire is out each company that has been on duty signals its return to the central office. In addition to the above, telegraph keys are provided by which each station can be signalled from the central office or any station can order supplies through a signalling code. There is also a telephone service between the central station and each of the engine and truck houses, independent of the city telephone exchange, and by means of which each company can talk with every other company and with the superintendent's office. This telephone

Digitized by Google

equipment can also be used in sending out the fire signals should anything be out of order with the regular signaling apparatus, making virtually a double system of communication.

The wires connecting the stations are run in subways within a radius of one mile from the City Hall. Besides the superintendent and the operators, there are five linemen, employed in connection with the signaling department.

The Introduction of Hard-Drawn Copper Wire.[1]

BY THOMAS B. DOOLITTLE.

DURING the fall of 1877 I received an order from the Tweedy Company, of Danbury, Conn., to equip their works with a telephone plant. These works consist of a group of buildings near together in one enclosure. Twelve stations were to be placed in the buildings. This was before the production of the carbon transmitter, and in order to obtain the best results from the magneto telephone I ran a continuous circuit of insulated soft copper wire from the office, through the several buildings and back to the office, making a metallic circuit of one wire and connecting the telephones in series at the several stations. Mr. J. J. Carty had not yet told us how to bridge them. The bell battery signals were run on a separate and entirely independent circuit, in order to relieve the talking circuit of the battery and bell coil resistance.

The next problem was to connect by telephone the several mills of the Ansonia Brass and Copper Company by means of a switchboard and radiating lines, comprising what is known as a "speaking tube system," in reality a private telephone exchange. This required considerable line building, and the soft copper wire was not suited to the purpose, it being lacking in tensile strength. I obtained permission to conduct experiments in the wire mill of the Ansonia Company, and after many trials succeeded in producing a hard-drawn copper wire which possessed the desired tensile strength and ductility to warrant a trial for line purposes. The entire system was equipped with this wire, as well as a portion of the Bridgeport (Conn.) telephone exchange.

My attempt to introduce hard-drawn copper wire met with decided opposition on the part of technical men, some claiming that the structure of the metal was impaired, and others that the conductivity was so reduced by the process as to make it little if any better than iron wire. These opinions came from most surprising sources, and were all given off-hand without investigation.

From time to time I caused sections of the wire to be taken down and sent to Boston and tested for conductivity, tensile strength and torsion. These tests were made by Dr. W. W. Jacques, then electrician of the American Bell Telephone Company. At the end of six years there was no perceptible deterioration either in weight, conductivity or strength. Measurements of hard-drawn copper wire made by Mr. John Stone Stone (Lake copper) have shown a conductivity of 100 per cent., and of electrolytic copper of something over 100 per cent., thus indicating that the standard of measurement is based upon tests of copper that was not altogether pure. It is demonstrated that the process of hard drawing does not impair the conductivity.

Having proved its value by lapse of time and exposure to the elements, Mr. Theodore N. Vail, then general manager of the American Bell Telephone Co., ordered the construction of an experimental circuit between Boston and New York. A contract was made with the Bridgeport Brass Company to furnish the wire, and I was placed in charge of the work. Associated with me was Mr. E. T. Gilliland, superintendent of the mechanical department of the American Bell Telephone Company, and a staff of young men from the laboratory, among whom were Messrs. H. S. Thornberry, Morgan Brooks and E. H. Lyon. The contract for building the line was made with the Southern New England Telephone Company, under Mr. E. B. Baker, general superintendent, with Mr. J. K. Butler in charge of the work. The cost of this experimental line was about $70,000, and the completion of the line marked the beginning of commercial long-distance telephone communication.

Like all new devices, hard-drawn copper has passed through an evolution to bring it up to its present standard of excellence. Among those who have contributed to this result are Mr. E. T. Gilliland, Dr. Hammond V. Hayes and Mr. F. A. Pickernell.

The successful operation of the experimental line making long-distance telephone communication possible initiated an extensive development of hard-drawn copper telephone lines throughout the world and in quick succession for all other aerial electric lines.

The utility of this material is shown by the increase in output in the United States alone from 100,000 pounds in 1885 to upwards of 80,000,000 pounds in 1896. It must be remembered that the low price of copper in recent years has had much to do with this result.

T. B. DOOLITTLE AND THE INTRODUCTION OF HARD-DRAWN COPPER WIRE.

Following the introduction of hard-drawn copper wire, which has now been largely extended to local telephone exchange service, and in some cases to the entire exclusion of iron wire, came the development of long-distance or inter-State lines, which have connected together the local companies in such a way as to form a comprehensive system throughout the country, whereby every subscriber to a telephone exchange may be placed in verbal communication with more than 60,000,000 of people in the United States and Canada.

[1]Mr. Doolittle has lately received the Edward Longstreth medal awarded by the Franklin Institute for his researches on hard drawn copper wire. In reply to an inquiry regarding its origin, Mr. Doolittle made the statement above.—Ed.

Long Distance Telephony for the B. & O.

The Baltimore & Ohio Railroad will shortly make the experiment of long-distance communication by means of the telephone. Work will be begun in a few days on two new copper telegraph lines between Baltimore and Pittsburg, a distance of 340 miles. These wires will be so arranged that when there is need for it they may be used for telephonic communication. One of the wires will be extended as far as Newark especially for telegraphic use. A new line is also being placed between Columbus and Cincinnati. To complete this line will require 800 miles of copper wire, weighing 166 pounds to the mile.

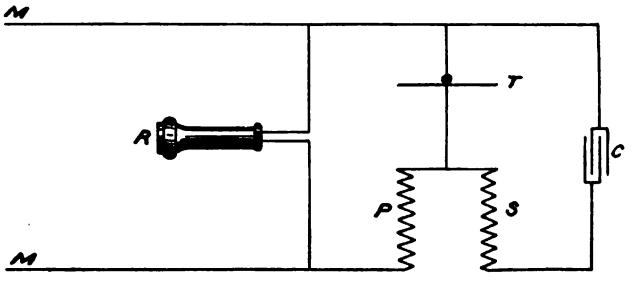
MR. CHAS. P. BRUCH, assistant secretary of the Postal Telegraph Cable Company, has now been appointed also assistant general manager, his duties being to assist General Manager Baker in all matters relating to that department.

Digitized by Google

Common Battery System for Chicago Telephone Exchange.

THE common battery system of telephone exchange operation as developed by the Bell Companies is now without doubt perfected to an extent where it will probably be only a matter of months and years until this system is installed to operate all the larger and many of the smaller Bell exchanges. The removal of all batteries, magneto generators and troublesome appliances from the subscribers' instruments and the supplying of all the electrical work from a common battery at the exchange is certainly an object that is worth spending considerable money in re-equipment to attain. The Bell common battery system has been standardized to a large extent, so that engineering difficulties are nearly weeded out.

The Chicago Telephone Company is putting in a new exchange station on the second floor of the Title and Trust Building, 100 Washington street, and in this installation, which is to be known as "Central," the common battery system will be used. It is understood that the "Express" telephones of this company's exchange will be changed onto this new common bat-



COMMON BATTERY RETURN TELEPHONE SYSTEM.

tery system and new telephones in the heart of the city will be put on it also.

The standard adopted by the Bell companies for common battery work is a 24-volt bank of storage cells charged by motor generators. From this 24-volt circuit the miniature signal lamps are operated and transmitters supplied.

As the arrangement of circuits for the transmitter in the Bell common battery system may not be familiar to some of our readers, we show a diagram of the circuits in the accompanying engraving. M M are the main wires from the central office, R is the receiver bridged across the mains, T is the transmitter, S and P are the primary and secondary coils of a transmitter coil connected in as indicated, and C is a condenser. S and P are so connected relatively to each other that the charge and discharge of the condenser with the voice currents tends to magnify the vibrations in the main transmitter circuit leading to the central office. Thus, when the resistance of the transmitter decreases, the increased flow of current through the primary tends to make a current flow through the secondary to charge the condenser, and this in turn increases the current in the primary, and consequently in the main line wires. Then, when the resistance of the transmitter increases, the primary, acting on the secondary, tends to help the condenser discharge through the transmitter and oppose the voltage from the central office, thereby cutting down the current in the line wire. Thus, both the rises and falls in the transmitter circuit current are magnified by this beautiful and ingenious arrangement and the working of transmitters from a central office current supply is made practicable under all conditions arising in ordinary practice.

Waiving Bell Telephone Commissions.

The announcement is made that the American Bell Telephone Company have advised all their licensees that they will hereafter waive the commission that these licensees have been accustomed to pay on all long-distance telephone and telegraph business. This concession will, it is estimated, effect a saving for the N. E. Telephone Company of fully $100,000 annually and for the Erie Company about $50,000. It is said that the full block of $5,000,000 Bell Telephone 4s has been distributed among investors. The company realized 100.77 from the purchasing syndicate, which resold in part to brokers at 101.75. They finally went at 102 to the public, or close to a 3¾ per cent. basis.

A Bell and Independent Telephone Combine in the Northwest.

LAST week between 500 and 600 towns were drawn more closely to Minneapolis. They are towns throughout the southern and western part of Minnesota, northern part of Iowa and in South Dakota. Several hundred more towns are indirectly drawn closer to the northwestern metropolis. The new bond is established by an alliance consummated between the Northwestern Telephone Exchange Company on the one hand and the Western Electric System, the Western Electric Telephone Company, the Minnesota Mutual Telephone and Telegraph Company and all their dependent and allied companies on the other hand, which include the Southern Minnesota and Southern Dakota Telephone Companies, the Union Electric Telephone Company, the Minnesota Central Company and Western Minnesota Telephone Company.

The parties to the agreement agree that their respective long-distance lines shall hereafter operate in harmony and in direct connection. They will be interconnected so that any town in the territory of any company which is a party to the agreement can get direct telephone connection with any other town on any of the wires of the allied companies. Between 3,000 and 4,000 miles of long-distance line are put in connection with Minneapolis, making it possible to reach about 8,000 miles of wire from this city.

The Northwestern Telephone Exchange, as one part of the agreement, purchases the entire system of the Union Electric Company, which is the only one of the independent companies in the deal whose lines are paralleled by those of the Northwestern. The amount of cash involved in this transaction is not given, but it is the only cash consideration. The rest of the agreement hinges upon mutual benefits. Each of the parties to the deal—the Northwestern people on the one hand and the Independent people on the other—expect mutually to profit by the new arrangement and get additional business. The Independent people are to allow the Northwestern people to put the Bell instruments on the independent lines from end to end. The rental charged for them includes the cost of repairs and is so small that the independent people say it is about as cheap as they can keep their present instruments in repair.

Connections will at once be made between the two systems wherever necessary, and within thirty days communication between all points on both systems will be open. Those most intimately concerned in the new deal promise that rates will be fair and equitable. They will be on the basis of "one rate." That means that where the use of the telephone involves both Northwestern and Independent lines the rate will be the same as it would be for the same distance on the lines of one company.

This is said to be the first time a Bell company has ever entered into such an extensive arrangement with an independent system. Generally it has been the Bell policy to ignore or fight the independent companies. On the other hand, there is no transfer of stock, and the independent companies maintain their separate existence and build and maintain their own lines. The adoption of Bell instruments practically brings them into the Bell ranks.

There is now left in the general territory outlined above not a single independent long distance line. The new alliance does not intend to combat local independent exchanges. They will be offered connections with the long distance lines if their service is good.

There is much speculation as to what will be the effect of this agreement on the Mississippi Valley Telephone Company, which is now putting in an independent exchange in Minneapolis. It seems to be shut off from all long distance connections unless it builds its own long distance lines. All the parties to the agreement are bound not to have any business relations with other companies, thus preventing outsiders from making any sort of connections with them.

Western Union Figures.

The estimated statement of the Western Union Telegraph Company for the quarter ending September 30, as compared with actual figures of the same period a year ago, shows revenues, $1,550,000, a decrease of $153,851; interest, $224,500, an increase of $82; balance, $1,325,500, a decrease of $153,933; dividend, $1,216,990, an increase of $18; surplus, $108,510, a decrease of $153,951;

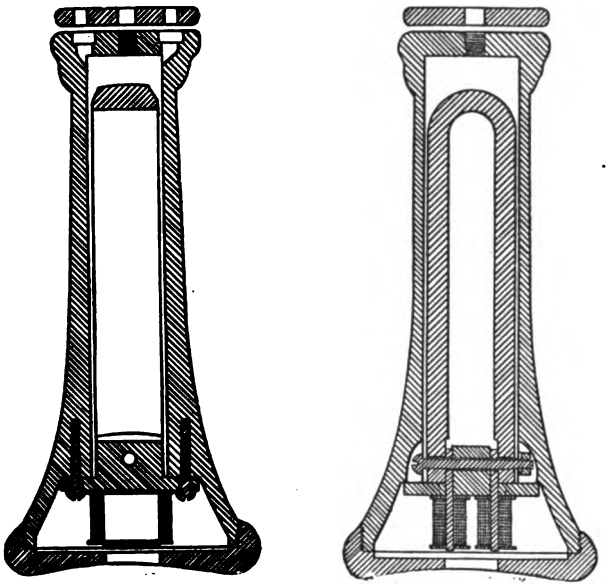
Digitized by Google

previous surplus, $7,963,235, an increase of $315,694; total surplus, $8,071,745, an increase of $161,743. A quarterly dividend of 1¼ per cent. has been declared.

The "W. & C." Telephone Receiver.

THE independent telephone manufacturers and exchanges have been laboring under certain difficulties ever since their beginning. Most of these difficulties have been overcome, one at a time, by improved methods and improved manufacturing. One of the greatest difficulties and the last to be remedied is the independent telephone receiver. This, as well as the transmitter, is absolutely essential to good service, and it is asserted that until to-day there has been no really first-class receiver produced at a price within reason.

The W. & C. bipolar receiver, which has just been placed on the market by Whitman & Couch, of Boston, is regarded by them as being as perfect a receiver as has ever yet been produced, one that will, no doubt, make many an exchange which has been laboring a long while trying to get good service and to reduce expenses as well, see that by doing away with a trouble-hunter, constantly adjusting the old style receivers and replacing them with a permanently adjusted receiver, they will save money



FIGS. 1 AND 2.—"W. & C." TELEPHONE RECEIVER.

and make lines heretofore almost useless talk up as well as when the old style of receiver was first installed.

The cuts Figs. 1 and 2 represent the longitudinal sections of the W. & C. bipolar receiver, showing the heavy magnet, brass spools and the new method of fastening the interior of the shell, so that expansion and contraction of the shell affects the adjustment in no way. As will be seen by the cuts, the magnets are secured to the pole-pieces by a bolt, which binds the two together upon the brass bed plate. Thus the whole interior is as of one piece. This is all held in the shell by two machine screws at a point so near the diaphragm that the shell can contract or expand without changing the adjustment.

The shell is made of the best hard rubber and is turned off and polished. The interior of the shell is not round like other shells, but is rectangular, with the corners rounded, thus forming a close fit to the magnet and giving great strength to the shell itself.

The pole pieces are nickel-plated brass, and the soft iron cores are milled off absolutely even and parallel. Wherever the connections from pole-piece and magnet occur the su faces are milled, thus giving the best possible contact space.

As a whole, the receiver is put forward as the best that can be obtained, with A No. 1 material, labor and electrical knowledge, and should find a place on every telephone circuit in the country.

ELIZABETH, N. J. The American Automobile Company has been incorporated, with a capital stock of $500,000. Its headquarters will be at Plainfield, where it will engage in the manufacture of motors and other electrical apparatus for horseless vehicles, etc.

ELECTRIC LIGHTING.

Depreciation of Candle-Power of Welsbach Mantles.

GAS companies have very generally claimed that the mantles used with Welsbach burners maintain their candle power practically constant until the mantles are destroyed. Recent investigations, however, show that the depreciation of candle power in Welsbach mantles is as rapid as, or even more rapid, than in the filaments of incandescent lamps. The accompanying curves show the average results of a series of tests made on incandescent lamps of General Electric manufacture and Welsbach burners.

Curve 1 shows that a good 32 candle power incandescent lamp burns 415 hours before its candle power drops to 80 per cent. of the initial value. Curve No. 2 shows that a Welsbach burner suffers the same depreciation in only 230 hours. In other words, the depreciation of the Welsbach mantle is so much greater than that of the incandescent filament that the Welsbach burner drops to 80 per cent. of its initial candle power 185 hours sooner than the incandescent lamp.

Economy dictates the substitution of a new incandescent lamp when the initial candle power has depreciated to 80 per cent., but taking into account the high first cost of Welsbach mantles and the low cost of operation, a mantle would undoubtedly be continued in use until its candle power has dropped much lower. In this case the customer would be obliged to consume the same amount of gas and thus be at the same expense, although the light obtained would be much diminished in power. For example, if a Welsbach mantle having an initial candle power of 32 were burned for 500 hours its candle power, according to the curve, would drop about 27 per cent., leaving approximately 23.4 candles.

In 1897 tests were made in Berlin, in which two English and three German mantles were tested. The standard of light used was the Heffner amyl acetate lamp, in connection with a Lummer-Brodhun photometer, the gas being measured by an Elster experimental gas meter. Much care was taken to secure uniform and reliable results, the room being thoroughly ventilated and draughts at the same time avoided, as it has been found that the light is materially affected if there is not an ample supply of fresh air. The horizontal candle power was measured in three directions, 120 degrees apart, and the mean taken as the correct reading, the measurements being taken every twenty-four hours. The final table, which contains practically all the important results, is given here:

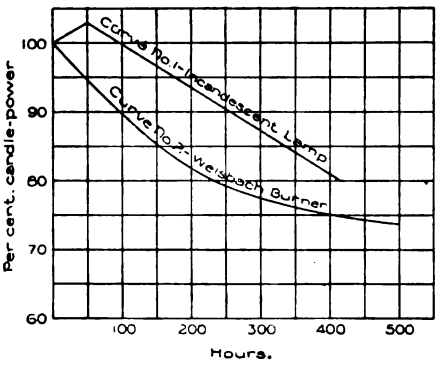
Make of Mantles.	Candle-Power.			Percentage Fall.	
	New.	100 Hrs.	500 Hrs.	In 100 Hrs.	In 500 Hrs.
English mantle No. 1.....	36.	33.4	14.	7.2	61.2
English mantle No. 2.....	52.9	49.	29.7	7.4	43.8
German mantle No. 1.....	70.3	49.7	28.2	29.3	59.9
German mantle No. 2.....	53.5	40.3	33.3	24.7	37.7
German mantle No. 3.....	62.6	57.1	47.5	8.8	24.1

An important feature in connection with incandescent gas burners is that of the proportion of the size of the mantle to the Bunsen burner. In many cases the mantle is much too large for the burner, and, in consequence, does not become properly incandescent all over. It also shrinks and warps out of shape to a much greater extent than when smaller. Tests also showed that the light absorbed by mica chimneys as compared with glass was as much as 9.4 per cent.

Mr. E. A. Medley, who made the report of these tests, sums up as follows: "The mantles give a wonderfully good light when new, but the extreme rapidity with which the light falls off and the consequent shortness of their efficient life, even when treated with every consideration due to their somewhat delicate constitutions, makes them far from an ideal illuminant. With the possible exception of the German mantle No. 3, a great deal of improvement is necessary before, for domestic lighting at any rate, they can be considered satisfactory." The depreciation of candle power of Welsbach mantles should be thoroughly consid-

Digitized by Google

ered in connection with the heat given out, consumption of oxygen from the air, contamination of the air, inconvenience of lighting, danger from fire and other disadvantages which are



CURVES OF LAMP AND MANTLE DEPRECIATION.

common to any gas system, and station managers may find from the facts given above cogent arguments in favor of eliminating these disadvantages by discarding the Welsbach burner for the more convenient and more satisfactory electric lamp.

The Gear Cutting Work of Van Dorn & Dutton Company, Cleveland, O.

THIS company claims to be the second largest manufacturer in the country, of gears and pinions for street railway service, although the output of the works is not confined to this particular product, but embraces standard cut gears for all purposes up to 54 inches in diameter. The works occupy a new brick building at 1796 East Madison avenue, having a ground area of 40 by 160 feet, and three stories in height, with basement. The heavy tool equipment, including the large planers and lathes, together with 100-ton wheel press, occupy the basement. Here are also located the heating appliances consisting of a

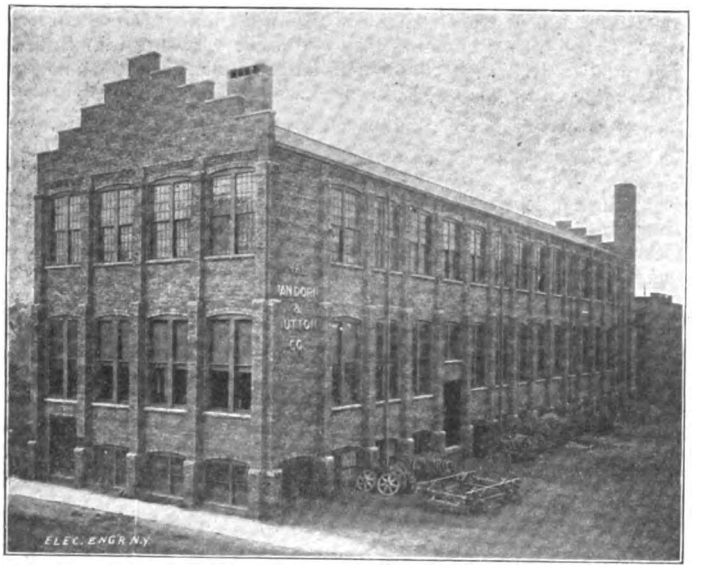


FIG. 1.—GEAR CUTTING SHOPS OF VAN DORN & DUTTON, CLEVELAND, OHIO.

Sturtevant fan and a case of steam pipes through which the air is forced, and from which it is led to the upper floors through galvanized iron conductors with suitable branches. The blacksmith forges are also located in this department, together with a 65 h. p. engine which furnishes the power for the entire works, including the operation of a freight elevator. The principal tool equipment, however, is located on the first floor, and includes a large number of special machines, the most interesting of which are the milling machines on which the gears are cut. These are sixteen in number, and are placed in two rows, side by side, near the back end of the room. The number of these machines is being constantly increased to keep up with the demand, and three new ones have been recently ordered. The equipment embraces machines manufactured by Gould & Eberhardt, Brain-

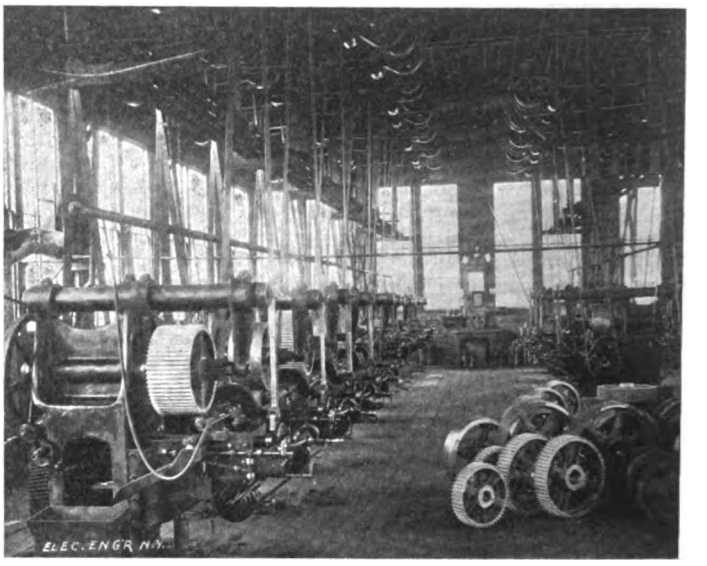


FIG. 2.—MACHINERY FOR GEAR AND PINION CUTTING.

ard and special machines of other make. Among the other special machines is a large turret-headed lathe known as a gear lathe, of sufficient capacity for boring and turning the largest size motor gears. The material from which the gears are cut is steel, malleable iron and cast iron. Not only solid pinions are manufactured, but also rawhide pinions and pinions composed of rawhide and steel. The steel plates from which the latter are made are first cut or stamped out, from ⅜-inch metal, then bored, and after being assembled are turned down to proper size, when the teeth are milled as for solid blanks. The works employ a large force of men, and the capacity of the establishment is 20 gears and 40 pinions a day. The company not only enjoys a large patronage from local street railways, but supplies gears for street railways in all parts of the country.

The active members of the firm are J. H. Van Dorn, president, who is also proprietor of the Van Dorn Iron Works, which are located in the same neighborhood, and in which over 200 men are employed, the product being structural steel work. W. A. Dutton, formerly Dorner & Dutton Company, is secretary and treasurer, and the superintendent is Mr. Franklin Schneider, formerly assistant superintendent in the shops of the Brush Electric Company.

Y. M. C. A. Classes.

At this time of the year many young men who are engaged in business in the daytime are making their plans to study in evening schools. These are the young men who think, and think to a purpose, and are advanced in business by reason of their increased value to their employers.

The Young Men's Christian Association conducts evening classes in commercial, scientific and language courses. At the West Side Branch of the Association, 318 West Fifty-seventh street, New York, the opening exercises of the educational classes will be held in the Auditorium on Monday evening, October 3, at 8:15 p. m. Rev. J. M. Buckley, D. D., editor of the

Digitized by Google

New York Christian Advocate, will make the address of the evening and music will be furnished by the Orpheus Mandolin and Guitar Club and Mr. J. Armour Galloway. The West Side Branch is the most modern and best equipped building for association work in this country, and on this evening all its rooms will be open to visitors.

Further information may be obtained of the Secretary, Dr. D. E. Yarnell, 318 West Fifty-seventh street.

PERSONAL

Mr. C. S. Sergeant.

THE portrait we present here of Mr. Sergeant, the new president of the American Street Railway Association, is one which does him justice, having been taken in response to a request for it. He is now 46 years of age, having been born at Northampton, Mass., in 1852. He became connected with the Eastern Railroad, in Boston, in 1876, and as general auditor, reorganized the company's accounting system. In 1887 he took

MR. C. S. SERGEANT.

the position of auditor with the West End Street Railway Company; in 1891 he became second vice-president, and in 1892 general manager of the entire system. He has therefore a ripe experience with all the inner details of steam, horse and electric railway management, and during the past year has been deeply engaged in carrying out the adjustment of the West End system to the new Boston subways.

PROF. F. W. CHANDLER, of the Massachusetts Institute of Technology, has accepted the invitation of the Executive Committee of the Massachusetts Charitable Mechanic Association and will serve on the board of judges of the Shattuck prize competition of designs for artisans' homes in conjunction with Prof. H. Langford Warren, of Harvard, and Mr. J. M. Carrère, of New York.

LIEUT. T. H. WOOD, of the Gloucester, has returned to civil life and is resuming his duties as president of the Ball & Wood Engine Company. He had a very active part in the Havana blockade, the bottling-up of Cervera's fleet, the destruction of the Pluton and Furor, the surrender of Santiago, the attack on Porto Rico and other episodes of the war. The campaign was trying and exhaustive, but he would not have missed the experience for a good deal. He has a number of souvenirs of his fights.

MR. W. J. CLARK, manager of the railway department of the General Electric Company, is the author of a very interesting work on "Commercial Cuba," which the Scribners are just about bringing out. It will deal with the practical possibilities of West Indian trade and commerce as viewed by a shrewd and competent observer who has spent some time in that part of the world.

MR. J. G. HICKCOX. We take great pleasure in announcing the engagement of Mr. J. G. Hickcox, secretary and treasurer of the Cutter-Hammer Manufacturing Company, of Chicago, to Miss Claire Whitcomb, daughter of H. F. Whitcomb, Esq., general manager of the Wisconsin Central Railroad. Mr. Hickcox has by his uniformly courteous business methods made for himself a host of friends in the electrical business who will all be glad to hear of his approaching happiness and wish him good luck.

COL. EUGENE GRIFFIN, U. S. A., first vice-president of the General Electric Company, has returned home from Porto Rico, whither he went with the First Regiment of the U. S. Volunteer Engineer Corps. He is resting at home to recover from general debility, having lost thirty pounds in weight in the six weeks of absence.

MR. E. W. DAVIS, formerly superintendent of the McKeesport & Reynoldton branch of the Union Traction Company, Pittsburg, has become general manager of the Versailles Traction Company's lines, running between McKeesport and Versailles.

SOCIETY & CLUB NOTES

Old Time Telegraphers at Omaha.

One of the most largely attended meetings of the Old Time Telegraphers' Association ever held convened in the Bee Building, Omaha, Neb., on September 13. Mayor Moore delivered an address of welcome and presented a key to the city in the form of a telegraphic key. A. H. Bliss, of Chicago, responded on behalf of the Association. The next annual meeting of the Association will be at Boston. The following officers were elected: Thomas Roche, Boston, president; John Brant, New York, secretary and treasurer. The executive committee will include these officers and H. J. Petingall, Boston; James Compton, Nashville; J. J. Dickey, Omaha, and S. A. Duncan, Pittsburg.

The Society of the United States Military Telegraph Corps also met in annual convention at Omaha. The feature of the meeting was the report of President Wilson, who reviewed the work of the year, especially the efforts to secure recognition for the military telegraphers along with the other arms of the service, the arrangements for membership in the G. A. R. and the tender of service to President McKinley. The following officers were chosen for the ensuing year: President, W. B. Wilson, of Philadelphia; vice-president, James Ives, of New York; secretary and treasurer, J. E. Pettit, of Chicago.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. The one hundred and twenty-seventh meeting of the Institute will be held at 12 West Thirty-first street, New York City, on Wednesday, September 28, 1898, at 8 o'clock p. m. A paper will be presented by Charles P. Matthews, of Purdue University, Lafayette, Ind., on the "Photometry of the Enclosed Alternating Arc."

PITTSBURG, PA.—The Pennsylvania Tube Works is about to introduce electric power in its new plant on Second avenue, substituting electric motors for a large number of small stationary engines. The tube mills have used 150,000 pounds of coal per month, and it is expected to save one-third of this by resorting to electricity, besides gaining incidental advantages in cleanliness, convenience, etc.

Digitized by Google

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued September 20, 1898.

Batteries, Secondary:—

ELECTRIC BATTERY. V. Jeanty, Paris, France, 611,012. Filed Oct. 21, 1897. The exciting liquid is, chemically speaking, kept separate from the depolarizing liquid, although electrically the electrodes are directly connected.

Conductors, Conduits and Insulators:—

ELECTRIC COUPLING. J. F. McElroy, Albany, N. Y., 611,000. Filed Jan. 9, 1896. A coupler adapted for use in coupling the electric cables supplying heat or light to a train.

Distribution:—

SYSTEM OF ELECTRICAL DISTRIBUTION. C. F. Scott, Pittsburg, Pa., 611,151. Filed Oct. 22, 1897. Means whereby a single-phase circuit in a three-wire system may be supplemented by a fourth conductor in such manner as to provide a four-wire, two-phase circuit suitable for the operation of two-phase alternating current motors, as well as single-phase translating devices.

Dynamos and Motors:—

SAFETY DEVICE FOR DYNAMO ELECTRIC MACHINES. E. M. Hewlett, Schenectady, N. Y., 610,904. Filed April 4, 1898. Combines, with an electric generator, a prime motor driving the generator, a governor for the prime mover, and means controlled by the governor for interrupting the circuit of the generator.

COMBINED GENERATOR AND STEAM ENGINE. M. L. Whitfield, Memphis, Tenn.. 611,006. Filed Nov. 16, 1897. Consists of a field magnet, having its interior hollowed so as to constitute a piston chamber, and having valve passages formed within the field magnet in combination with a piston and suitable valve mechanism.

Electro-Metallurgy:—

APPARATUS FOR ELECTROPLATING ARTICLES IN BULK. G. Langbein, Leipsic, Germany, 610,007. Filed Jan. 22, 1898. An apparatus adapted to hold articles to be electroplated, the apparatus being given a rocking movement instead of a rotary movement.

METHOD OF FORMING INTEGRAL METALLIC COATINGS UPON SURFACES. E. T. Thomas, New York, 610,954. Filed April 27, 1892. Especially applicable to marine use, as for ships, the metal forming one continuous integral coat of electrically deposited and united material.

ELECTROPLATING APPARATUS. H. R. Boisser, New York, 611,100. Filed Jan. 14, 1898. Consists of a tank containing a work-supporting cathode and movable about any upwardly arranged axis, an anode above the cathode and supported independently of the tank and cathode, and power devices to rotate the tank.

APPARATUS FOR ELECTRICALLY COATING WIRE. W. S. Rawson, London, England, 611,148. Filed Dec. 24, 1897. Details of construction.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. M. Harris, New York, 610,898. Filed Oct. 27, 1897. An enclosed arc lamp of such construction as to permit the trimming of the lamp without the removal of the globe.

ELECTRIC ARC LAMP. F. S. Worsley, London, England, 611,162. Filed March 15, 1898. Is provided with short-circuiting devices comprising in combination with the main coil of the lamp and its core, a piece of magnetizable material with which the core is adapted to come into contact and short circuit the carbons when their proper feeding is interrupted.

Measurements:—

ELECTRIC METER. C. D. Haskins, Newton, Mass., 610,899. Filed June 24, 1898. A method of calibrating an electric meter, which consists in changing the current flow in the starting coil to compensate for local errors without changing the current flow in the armature circuit.

ELECTROSTATIC MEASURING INSTRUMENT. E. Thomson, Swampscott, Mass., 610,928. Filed March 27, 1897. Comprises stationary inductors and a vibrating needle, the vanes of the needle being segments of a cylinder, with a permanent magnet whose lines of force cross the path of one of the vanes of the needle at right angles thereto.

Miscellaneous:—

ELECTRIC HEATER. J. F. McElroy, Albany, N. Y., 610,999. Filed March 18, 1895. Designed for street car use. Details of construction.

ELECTRIC HEATING SYSTEM. J. F. McElroy, Albany, N. Y., 611,001. Filed July 6, 1896. A system of car-heating utilizing electricity generated by the motors which are run as generators, when disconnected from the source of power.

ELECTRIC FURNACE. R. Pignotti, F. Lori, S. Regnoli, M. Besso and M. Pantaleon, Rome, Italy, 611,142. Filed June 27, 1898. Consists of a furnace having a substantially air-tight chamber, in which the reactions take place for the purpose of preventing the combustion of the gases generated and of diminishing the waste of the electrodes.

METHOD AND MEANS FOR MANUFACTURING METAL TUBING. E. E. Ries, New York, 611,222. Filed Jan. 18, 1896. Means to produce tubing, in which the meeting edges are welded together in such manner that the tubing may be redrawn cold without weakening the joint, a process only possible heretofore with ingot or weldless-formed tubing.

Railways and Appliances:—

RAIL BOND. J. E. Lloyd, New York, 610,909. Filed Nov. 12, 1898. Details of construction.

TROLLEY. O. W. Swanson, Tacoma, Wash., 610,927. Filed Sept. 18, 1897. Comprises a center member provided with opposite hubs, squared at the outer extremities, and provided with an annular recess between the member and extremity.

ELECTRIC RAILWAY CONSTRUCTION. W. Chapman and P. W. Davis, Pittsburg, Pa., 611,056. Filed Nov. 23, 1897. A contact rail of inverted trough shape, in combination with a clamp having jaws for gripping the rail edges, a block provided with a socket for the supply conductor, a plastic bond between the block and the rail and a wedge between the block and the clamp.

ELECTRIC RAILWAY CAR TRUCK. G. J. Capewell, Hartford, Conn., 610,894. Filed June 14, 1898. Designed for a single rail track.

ELECTRIC BRAKE. J. B. Linn, Schenectady, N. Y., 610,908. Filed Jan. 7, 1898. Combines a number of dynamo electric armatures and brake mechanisms upon common axles, and means for passing the current from one armature through the field of another of the dynamo-electric machines.

ELECTRIC LOCOMOTIVE. W. S. G. Baker, Baltimore, Md., 610,982. Filed Nov. 24, 1894. Details of construction.

Regulation:—

CONTROLLER FOR ELECTRIC MOTORS. F. E. Case, Schenectady, N. Y., 610,895. Filed April 2, 1898. Comprises a controller for electric motors operated in pairs in series or parallel, three-blade, cut-out switches for each motor, the outer blades of which shift the motor connections, so that the motor corresponding to any switch operated is cut out at both ends, and the remaining motors are connected in parallel, and the middle blade of which opens a connection common to all the switches.

GOVERNING, REVERSING AND BRAKING CONTROLLER. T. Von Zweigbergk, Cleveland, O., 611,088. Filed Feb. 23, 1898. Details of construction.

METHOD AND MEANS FOR CONTROLLING AND CUTTING OUT ELECTRIC MOTORS. T. Von Zweikbergk, Cleveland, O., 611,089. Filed April 29, 1898. Comprises a series parallel governing-switch, two lines leading from the governing switch to the reversing switch, and a cut-out in each of these lines, the cut-out being adapted to open the line without connecting it with any other line, and means for holding the cut-out in this open position.

CONTROLLER. T. Von Zweigbergk, Cleveland, O., 611,090. Filed April 29, 1898. Embodies a reversing switch with a disengagable connection between its operating lever and its body, and means whereby such connection may become disengaged when the current is turned on.

ELECTRIC CONTROLLER. S. Harris, Twinsburg, O., 611,215. Filed May 2, 1898. Comprises a pair of concentric shafts, a pair of switch cylinders carried thereby, two sets of fixed fingers engaging them, and a single mechanism arranged to actuate either of the shafts.

Switches, Cut-Outs, Etc.:—

AUTOMATIC CIRCUIT BREAKING SWITCH. W. F. Bossert and W. D. Pomeroy, Utica, N. Y., 610,887. Filed July 12, 1897. An electrical catch for securing the switch in open position, the catch being operated by a normally open sub-circuit closed by the switch in open position with reference to the main circuit.

CIRCUIT BREAKER FOR THREE-WIRE SYSTEMS. E. M. Hewlett, Schenectady, N. Y., 610,903. Filed Sept. 7, 1897. Comprises a main switch, having a plurality of coils, and a relay having differently wound coils connected in the two sides of the three-wire system, with a circuit controlled by the relay, including one of the coils upon the circuit breaker.

CONTACT FINGER FOR CONTROLLERS OR ELECTRIC SWITCHES. T. Von Zweigbergk, Cleveland, O., 611,087. Filed Feb. 23, 1898. Details of construction.

RHEOSTAT. C. H. Richardson and L. McMakin, Jr., Philadelphia, Pa., 611,185. Filed Feb. 3, 1898. Comprises a case, a resistance track, a movable contact arm, the handle for turning the contact arm provided with a dial plate, and an index supported in fixed relation to the rheostat case.

CIRCUIT INTERRUPTING DEVICE. D. McF. Moore, Newark, N. J., 611,206. Filed July 3, 1897. A brake wheel of metal filled in between the contact surfaces with vitreous insulating material.

REPORTS OF COMPANIES

Details of the Westinghouse-Walker Consolidation.

MR. GEORGE WESTINGHOUSE, president of the Westinghouse Electric and Manufacturing Company, makes the following announcement on behalf of his company:

"The election this day of Roswell P. Flower and Anthony N. Brady as members of the Board of Directors of the Westinghouse Electric and Manufacturing Company to represent the interests of the former stockholders of the Walker Company completes the union of the interests of the Walker Company, of Cleveland, with those of the Westinghouse Electric and Manufacturing Company. The purchase by the Westinghouse Company includes substantially all of the outstanding stock and all but $850,000 of the $2,500,000 of the twenty-year bonds of the Walker Company, the $850,000 remaining a first lien upon the property. The recent sale by the Westinghouse Company of $3,000,000 of debenture certificates has erroneously been connected with this transaction. The entire proceeds of the sale of these debenture certificates were used in retiring the floating and other debt of the company, as previously announced.

"The increase in the total yearly fixed charges of the Westinghouse Company, due to the purchase of the Walker Company, will be but a little more than the sum that the Walker Company has been expending annually in defending patent litigation instituted by the General Electric and Westinghouse Companies. The acquisition of the Walker Company will, by reason of the agreement of March 31, 1896, between the General Electric and Westinghouse Companies, put an end to this patent litigation and very large anual expenditure on both sides. The business of the Walker Company, as a controlled company of the Westinghouse

Digitized by Google

Company, will be entitled to the protection of the patents of the Westinghouse and General Electric Companies, and will in all respects be subject to the agreement between these two companies in relation to patents.

"The Westinghouse Company regards the business and good will of the Walker Company as a valuable acquisition, especially as the Walker Company brings with it upward of $1,250,000 unfilled orders. The Walker Company has at Cleveland modern and extensive works, equipped with machinery capable of manufacturing the largest types of railway apparatus, and will, with the works of the Westinghouse Company at East Pittsburg, constitute a manufacturing plant second to none in the country. The capacity and profits of the two companies will be increased by carefully harmonizing the manufacturing and selling operations, and the direct savings thereby effected should exceed the fixed charges incurred by the purchase of the Walker Company. The shipments of both companies, owing to the large orders on hand, have been increasing during the past few months, and exceeded $750,000 for August.

"The total fixed charges of the Westinghouse Company, including those due to the Walker purchase and the dividends on its preferred stock, will be $42,000 per month."

The Safety Third-Rail Electric Co.

Papers incorporating the Safety Third-Rail Electric Company, of New York, have been filed with the Secretary of State. The company has a capital of $1,000,000. Its directors are Emerson McMillin, Emerson McMillin, Jr., W. F. Douthirt, C. T. Scoville, R. H. Beach, Wm. M. Keepers, David F. Halsted, John McLeod Murphy and Louis Steckler, of New York City. It owns the Murphy third-rail system, which has attracted so much attention of late and which has been very fully described in The Electrical Engineer.

A Good Fall Outlook.

The course of events in Wall street has been a trifle dull and downward owing to the dearness of money, but it looks as though an upward turn might come any moment, for money is not so dear after all, and gold is coming this way. General trade conditions are reported excellent and again a strong foreign demand for our wheat at rising prices has made itself felt. All the authorities who have been interviewed on the subject predict an active fall trade. Out West it is already very good.

During the past week 7,662 shares of Western Union were sold, closing at 92⅛. New General Electric stock sold well to the extent of 18,200 shares, closing at 78¼. New York Metropolitan Street Railway sold up to 156¼ on 7,864 shares. New York Edison closed at 131. In Boston, American Bell Telephone closed strongly at 282 and West End Railroad at 85¼.

Copper, New York, was 12¼ cents. Heavy steel rail, Eastern mill, $18. A better price is looked for in iron and steel.

Western Electric Company.

Bulletin No. 7,002 has just been issued by the Western Electric Company, Chicago and New York, and is a comprehensive pamphlet dealing with the arc lighting system, arc lamps and accessories developed by this company. The lamps illustrated and described are the following: Open arc lamps, for constant current, double carbon, single narrow and wide frame outdoor lamps, narrow frame single carbon waterproof lamps, single side rod lamps, ornamental lamps, low ceiling lamps, focusing lamps specially adapted for street lighting, open arc constant potential lamps for indoor and outdoor use, the Krueger theatre lamps, with patent lens box for the concentration of light, and an Olivette box for the dispersion and coloring of light. Enclosed arc lamps, plain chain feed lamps for 110-volt circuits and a life of from 130 to 150 hours, ornamental chain feed and direct carbon feed lamps and others. For each type of lamp data as to the amperage, voltage, length of carbons, hours of burning in one trimming, length over all in feet and inches, weight with globe, size and style of finish are given. The catalogue also contains a description of the bell insulator and hanger switch, arc light line switches and globes. It will be sent to anyone on application.

In all the fortifications along our coast defenses the fire commander's station is connected with the battery commander's station both by telephone and by speaking tubes, one acting as a reserve for the other. Considerable of the A-1 lap-seamed speaking tube manufactured by the Western Electric Company was used by the Government.

Dry batteries have been found very useful for signal service in the field. The Western Electric Company manufacture the W. E. dry battery, which has a high efficiency and long life and is admirably adapted for emergencies.

This company, of New York and Chicago, have recently issued a small pamphlet illustrating electric linemen's construction tools and hardware specialties such as splicing clamps, climbers, shovels, spoons, digging bars, poles, hooks, reels, wrenches, pliers, vises, come-alongs, brick drills, belts, pulley blocks, ladles, torches, etc. The catalogue will be sent to anyone on application.

Columbia Phonograph Company.

A very amusing and useful catalogue has just been issued by the above company, 1155 Broadway, New York, about the machine that talks, and contains a great deal of valuable information as to the correct and varied use of the graphophone. It points out its advantages in regard to speed, convenience, dispatch, accuracy, independence, economy, simplicity, tirelessness, progressiveness and subdivision of labor. Of the various types illustrated special mention should be made of the Columbia model, Bijou Universal, Coin-slot, and a continuous running graphophone. Electric motors and miscellaneous supplies are also furnished by the company. The catalogue will be sent any one on application. Accompanying it is a very neat little booklet entitled "The Old and the New," which must be read to be appreciated.

The Taunton Snow Plows.

A catalogue worthy of the company from whose press it is issued is one showing the standard and heavy-nose plow and the double-track share plow made by the Taunton Locomotive and Manufacturing Company, Taunton, Mass. The catalogue measures 8¼ by 10¼ inches, and contains beautiful half-tone illustrations of the exterior and interior of the various styles of plows manufactured by this company. There is also given a complete list of the users of these plows, specifications as to their sizes and prices.

Central Telephone & Electric Company.

A very attractive poster illustrating "Everything Used With Telephones" made by this company, located at 1123 Pine street, St. Louis, Mo., has been sent out to the trade and undoubtedly graces many sales rooms and offices. The following instruments are illustrated: The Improved series magneto bell, 20th Century and Excelsior telephone transmitter and the "Central" metal head receiver, desk telephone, etc. A description of each one of these instruments is given, and this poster will be sent to anyone on application.

The Largest Dynamo in the World.

This is the title of a very instructive booklet recently issued by the Walker Company, Cleveland, O., which contains a complete and detailed description of the 4,000 horse power machine built by this company for the Boston Elevated Railway Company. The article was written by Prof. Sidney H. Short, which in itself gives prominence and value to the material contained in the book. The latter is profusely illustrated and contains much valuable data which is certainly unique on account of the machine being the largest one ever designed and built. The

Digitized by Google

company have also distributed during the last month circulars No. 1080 to 1086 inclusive, dealing respectively with blow-out controllers, steel lighting generators, electric railway generators, the Love underground conduit, alternating current apparatus, Walker street railway motors and boosters. It is a very interesting and valuable set of catalogues, which contain a considerable quantity of valuable information.

The General Electric Co's. Literature At Omaha.

For distribution at the Trans-Mississippi Exposition at Omaha, the General Electric Co. issued from its press, a neat little brochure, very fully illustrated. As all the machinery used to light the grounds and buildings of the Exhibition and to supply the power was furnished by the General Electric Company, the types of apparatus shown in the book enable the visitor readily to identify each type as he meets with it in the exhibit or in any part of the working plant itself. On the back of the front cover is a general view on the exposition grounds, and throughout the entire book are pictures showing various buildings and interesting features. The book further illustrates General Electric lamps, single-phase generators, Brush arc generators, monocyclic generators in course of construction, transformers, wattmeters, railway motors, three-phase induction motors, fan motors, air-blast transformers, lightning arresters, railway controllers and other General Electric apparatus. The centre piece is a general view of the Schenectady works of the company. Many thousands of these little books have been printed and the demand for them at the exhibition has kept the company's presses fully occupied.

ELECTRIC STORAGE BATTERY COMPANY has issued in Circular No. 45 an interesting illustrated account of the storage equipment in the station of the Barre-Montpelier (Vt.) Traction Company, the line being the first in the United States operated exclusively from rotary converters with storage battery auxiliaries.

LEHIGH UNIVERSITY. The course of electrical engineering at Lehigh University is under the direction of Prof. W. S. Franklin, and a catalogue issued on the subject gives a large amount of useful information as to the curriculum, the equipment, etc. This institution at South Bethlehem, Pa., has done a large amount of good work in technical studies and is prepared to turn out qualified and well rounded men in all the departments of engineering.

MACHADO & ROLLER, 203 Broadway, New York, send out a very neat catalogue of instruments of precision, switchboard voltmeters and ammeters, etc., as made by the Whitney Electrical Instrument Company. It gives some eighty pages of very full and complete data in regard to the apparatus, whose durability and reasonable price have given it a widespread use.

THE JULIUS ANDRAE & SONS' COMPANY, of Milwaukee, Wis., have issued a revised price list of Andrae incandescent lamps. A copy will be mailed to any one interested upon request. The new telephone catalogue will be ready for distribution within a fortnight. The demand for O. K. and 1900 dry batteries is continuing at a healthy growth in Milwaukee and vicinity. Both these popular batteries are handled by the Julius Andrae & Sons' Company.

Fan Motors All the Year Around.

Even though, according to the calendar, the summer is at an end, the demand for Western Electric fan motors continues. The public has become educated to the advantages of good ventilation and the fan motor has been found to be one of the best means of preventing stagnation of air. It is also useful for drying purposes in photograph galleries, engraving establishments and laundries.

THE EMPIRE, one of Milwaukee's finest restaurants and cafes, has been equipped throughout with Lundell electric fans and motors by the Julius Andrae & Sons Company. The Sprague goods are very popular in the Cream City, nearly all the large and first-class hotels being equipped with the Lundell fans.

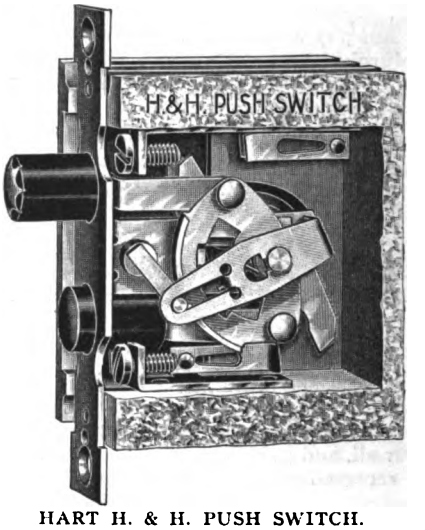
TRADE NOTES AND NOVELTIES

Hart H. & H. Push Switch.

THE Hart & Hegeman Mfg. Co., Hartford, Conn., claim that in their new push switch they have solved the problem that has bothered switch manufacturers for years and have produced a mechanism which can be operated with the least possible effort, at the same time making quick and positive contact. This feature alone has already rendered the switch popular, as it is desirable that in hotels, private houses and other places where women and children use switches, something should be employed which did not call for the strength of a man's hand to operate.

The mechanism is shown by the cut, but should be operated to be fully appreciated. It is encased in one piece of porcelain. The contacts are of the "knife switch" form. Switchplates are thoroughly insulated from the mechanism. The action is positive, the break long and the carrying capacity is ample. It is wired from the front, and the ease with which wiring can be done has been warmly commended by wiremen.

Through the courtesy of one of the largest central stations in the country an exhaustive test of the switch was made in their



HART H. & H. PUSH SWITCH.

inspection department, and the report received from their chief inspector reads as follows: "The switch tested was a double pole flush snap switch, encased in porcelain, except the front, which was of plain nickel, and rubber push buttons, one marked to indicate light. The action of the switch was quick and positive, breaking the circuit in four places. The switch was designed for 220 volts—10 amperes. The test consisted of making and breaking the circuit as follows: 115 volts, 15 amperes, 1,500 times; 230 volts, 15 amperes, 1,500 times; 230 volts, 20 amperes, 200 times. The switch worked perfectly free and no undue heating or arcing was observed. At the end the switch was taken apart for examination and was found in good order, hardly showing that it had been used. No disastrous effect of arcing could be detected."

The switch has also been tested and approved by the National Board of Fire Underwriters. The Hart & Hegeman Manufacturing Company report the receipt of letters from prominent electrical engineers in all parts of the country, all congratulating them on the result of their effort in the push switch line.

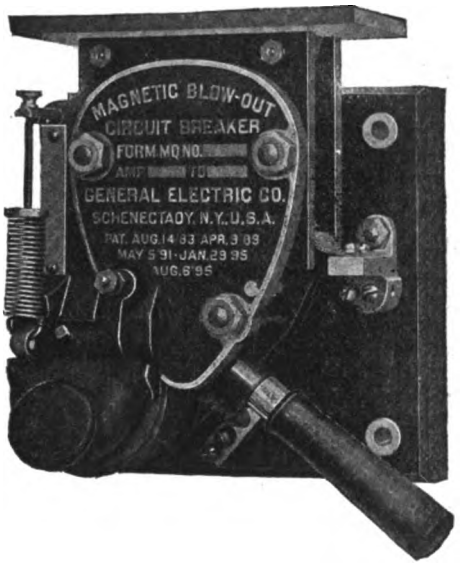
E. PHILLIPS & SON, South Hanover, Mass., are running their factory full time and full handed. Orders for pure rolled zinc plates, which they manufacture for electric batteries, etc., are coming in from all parts of the country. This firm, having a large output, are in a position to furnish large quantities and will be pleased to quote prices on any size and dimensions of zincs. Their Boston office is located at 107 Summer street and is in charge of Mr. Morrill A. Phillips.

Digitized by Google

General Electric Magnetic Blow-Out Automatic Circuit Breakers.

THE inherent tendency of all circuit breaking devices to draw an arc at the last point of contact introduces a serious problem in the design of all switches and cut-out appliances. The roughening effect of the arc on the contacts destroys in a short time the usefulness of the apparatus, and as the voltage and current increase the difficulty is rapidly magnified. The only commercially practicable way of breaking direct current circuits at 400 volts and above has been ascertained by exhaustive experiment to be by the use of a magnetic field, which destroys the arc at the instant of its formation, and promptly and positively opens the circuits and prevents injury to the contacts. The advantages of the use of the magnetic blow-out wherever a direct current electric circuit is to be opened are familiar to all users of electrical apparatus. By adding to a switch equipped with a blow-out magnet, a tripping device to open the circuit at a predetermined current, an automatic circuit breaker is obtained, which for convenience and reliability, may be said to be unsurpassed by any other form of cut-out.

The General Electric Company manufactures four different forms of magnetic blow-out automatic circuit breakers for different classes of service. Each is rated by two numbers, the first indicating the lowest current that will automatically open the circuit, and the second number giving the maximum normal current carrying capacity, except in case of the form M. M. circuit breaker, when the second number indicates the maximum capacity on the basis of intermittent service common in railway



M. L. MAGNETIC CIRCUIT BREAKER.—FRONT CONNECTED.

work. The tripping point is adjustable to any desired current, from the lowest rating to 50 per cent. in excess of the maximum capacity, by adjusting the calibrating spring of the tripping armature.

The four different forms in which these circuit breakers are made have certain radically different features, which adapt them to the special classes of service for which they are designed. All of them may, however, be used on any direct current circuit, and, with reasonable care and attention, will operate satisfactorily under the most severe conditions. Indeed, every case of injury to the circuit breaker may be traced to improper adjustment or neglect of some simple precaution.

In the designation of the different forms of General Electric circuit breaker, the first letter represents the general principle of operation; the second letter is arbitrary, or denotes some features of construction. For example, the first letter in the form designation of all magnetic blow-out circuit breakers is M; the second letter is arbitrary. The circuit breakers, formerly known as K, L, Q and M, are now known as MK, ML, MQ and MM, respectively.

The form MK circuit breakers are made for 150 to 8,000 amps. and are especially intended for severe service, such as on generator and feeder panels, where the circuit is subject to repeated and violent overloads. This circuit breaker can be recommended for the most severe conditions met in any class of service. The parts are extra heavy, in order to withstand constant and rough usage. Destructive arcing is prevented by the use of supplementary contacts placed in a strong magnetic field, and arranged to break the circuit a moment after the main contact. The transfer of the arc from the main to the supplementary contacts and the immediate extinguishing action of the magnet has made possible the construction of effective circuit breakers for 8,000 amps. capacity. The main contact, which is built up of leaf spring, bears upon the main contact blocks when the breaker is closed. The coil of the blow-out magnet and the secondary or plug contacts are in multiple with the main contact. Owing to the comparatively high resistance of the secondary contacts, practically no current passes through them until te main contact opens. The whole current then passes through the magnet coils, and the strong magnetic field extinguishes the arc as soon as it is formed on the plug contact. The plug is not withdrawn until after the leaf contacts have left the contact blocks.

The plug, or secondary contacts, and the inside of the boxes enclosing them, should be frequently examined, and any accumulation of carbonized material removed. If the secondary contacts are not kept in good condition and properly adjusted, the current will be broken on the main contacts and injury to the circuit breaker will result. A little vaseline on the secondary contacts tends to keep them smooth and increases their life. All parts of the circuit breaker should be kept clean.

All sizes of MK circuit breakers are furnished for back connection, up to and including 800-1,200 amps. capacity; they can also be furnished for front connection. Circuit breakers up to 1,200-2,000 amps. capacity are made when desired, with an automatic locking device operated by a handle. When the circuit breaker is open it can be locked by removing the handle. As the circuit breaker cannot be closed without the handle, removal of the handle prevents accidental or unauthorized closing of the contact. When the circuit breaker is closed the handle cannot be removed. The automatic locking device is especially valuable in street railway service, as it permits circuit breakers to be left open without danger of accidental closing. All the circuit breakers in a station may be thus placed under the exclusive control of a single operator.

For power circuits and classes of work where the conditions are less severe than in regular railway service, the General Electric Company manufacture the form ML circuit breaker for 100 to 800 amps. Its principle of action is the same as that of the form MK, but the moving parts are somewhat lighter, and differ slightly in general form. The form ML circuit breaker is made both for front and back connections, and in two capacities; 100-500 amps. for front or back connection, and 200-800 amps. for back connection only.

As in the case of the form MK, the main contacts of the form ML are laminated and connected in multiple with a secondary plug with a contact, upon which the arc is broken. The automatic locking handle is supplied on this circuit breaker.

The form of MQ circuit breaker is made from 15 to 100-175 amps. only, and is designed especially for protecting power circuits and stationary motors. In general appearance it is somewhat similar to form ML, but it has no secondary contact. The current is broken on a segmental contact similar to the contacts used in railway controllers. This form of contact has been found amply sufficient for the maximum capacity of this circuit breaker. There is but one coil for both the tripping magnet and the magnetic blow-out. The magnetic circuit is so arranged that the arc is ruptured in its field. The positive and instant action of form MQ circuit breakers affords greater protection to electric motors than fuses, or any other form of cut-out.

The form MM circuit breaker, for 15 to 150 amps. is designed especially for street car work, and consequently its rating is based on the intermittent currents usual in railway service. It should not be used where it will have to carry its maximum rated capacity continuously. The form MM circuit breaker is intended to supersede both the old hood switch and the fuse box. The fuse box, which has heretofore been the only protective device available for motor and other car equipment appliances, has usually been placed in a more or less inaccessible position beneath the car. The blowing of fuses resulted in annoying and troublesome delays, and the form MM circuit breaker was at once received with favor, as it affords perfect

Digitized by Google

protection to the apparatus and can be instantly reset. It resembles a main motor switch in appearance and answers the purpose of a switch in every way, being intended for location in the same position under the hood of the car platform. It can be set to open at any current within certain ranges and can be closed and opened by hand, exactly like the old main motor switch.

The Wheeler Porcelain Enamel Deflector for Street Lamps.

ELECTRIC light managers will be interested in a genuine porcelain enamel deflector, to be used in connection with the usual metal hoods over incandescent street lamps. This new deflector is produced by the Wheeler Reflector Company, of Boston, to meet the demand for a deflector that is durable and capable of permanently retaining its original finish.

To accomplish this they have placed upon the market a deflector made of heavy iron, completely covered with genuine porcelain white enamel, which is practically indestructible and always as good as new. It is adapted to the regular 14-inch

PORCELAIN ENAMEL DEFLECTOR FOR STREET LAMPS.

hoods made by the Wheeler Reflector Company, so universally used.

That these new porcelain deflectors are destined upon their genuine merits largely to supersede the ordinary painted tin deflectors heretofore obtainable is already evident by the hearty reception thus far given them wherever shown, and their almost unvarying adoption. The Wheeler Reflector Company will be glad to communicate with any who are interested in this direction.

Armorite Interior Conduit Co., Pittsburg, Pa.

TWO kinds of conduits for interior wiring constitute the principal products from the works of this company. Both are made from welded pipe. One process consists in coating the pipe, inside and out, with a plastic paint or compound, which, when baked in a peculiarly constructed oven or kiln, renders the coating water and acid proof as well as proof against electrolytic action, and it is not affected by heat up to 500 degrees, neither will it crack when the pipe is bent. In the process the scale and rust are first entirely removed from the metal by the action of suitable chemicals, and the compound is applied and fixed by the baking process. The finished pipe has a smooth interior, which facilitates the drawing in or removal of the wire. The tubing is manufactured in ten-foot lengths and of any size, with a full line of fittings.

The second process, and one that produces a conduit, received with great favor by consumers, consists in lining metal pipe of any size from ⅜ up to 6 inches in diameter, with a thin sheet of wood, or rather, the insertion of a close-fitting tube of wood. For this purpose "bosswood" is employed, which is delivered in planks from 1 to 1½ inches in thickness. These are first planed and then sawed into suitable strips 10 feet in length and of size corresponding to the tube to be filled. These strips are then run through a specially designed planer called a sticker, in which they are formed half round. They are again passed through the same machine, when the flat side is grooved out, leaving a shell from 1 to 3-16 inches in thickness, with a tongue and groove on the edges. The strips are then boiled in petroleum under air pressure until the pores of the wood are entirely filled, as in the creosoting process. When dry they are ready for insertion in the tubing. This is accomplished by placing the two half round strips on a rod or mandrel of proper size, with the tongue and grooved edges interlocking. The rod, with its sheath of wood, is then placed between two grooved rollers, and by their revolution is forced into the tube, which is clamped in position. The mandrel is then withdrawn, leaving the tube of wood as a close-fitting lining to the pipe. The ends are then trimmed and slightly reamed, so that when laid the coupling is so threaded that the ends of the pipes are drawn close together, leaving a smooth track for the insertion of the wire. For elbows the pipe is lined while straight and then is bent to a suitable curve, as the wood is elastic, and the two halves are so arranged that they slide one on the other and prevent cracking. The wood-lined tubing is then treated to a coating of japan and is finally bundled for shiping.

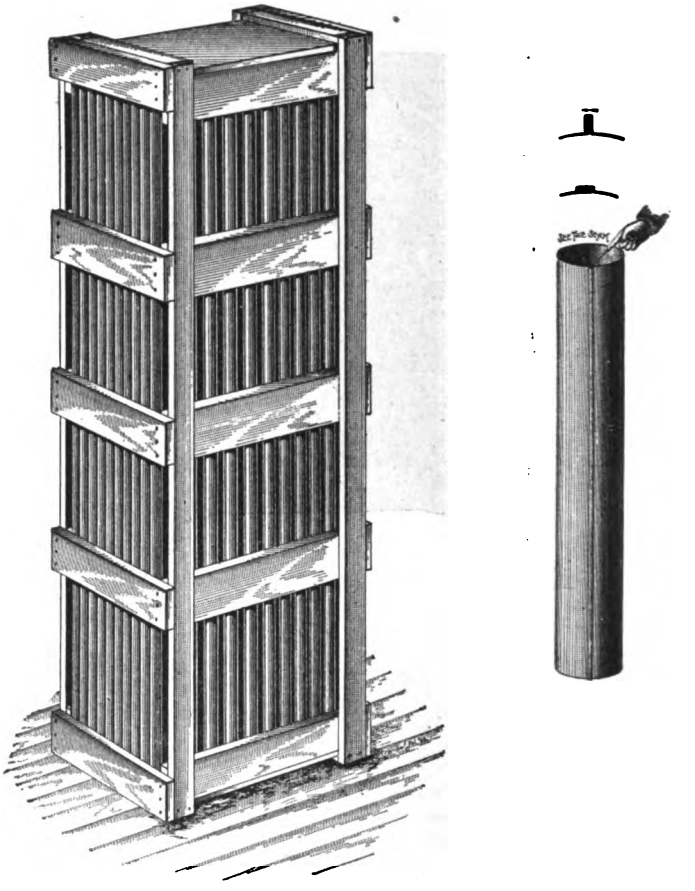
Power is supplied from a steam engine, while there are suitable air compressors and vacuum pumps as auxiliary to the process of baking and creosoting. The tool equipment includes circular saws, planers, four sticking machines, two filling machines and other small tools, giving a capacity for an almost unlimited output.

The works occupy a large building on Second avenue, near Try street, and are operated under the direction of Mr. A. W. Smith, superintendent.

Western Electric Speaking Tube.

IN the electrical supply business the speaking tube has been so closely associated with electrical signalling devices—bells, annunciators and similar apparatus, that it has always been considered one of the necessities for well-stocked electrical supply houses.

The Western Electric Company has manufactured speaking tubes for a number of years, and a special feature of its speaking tube is the lap-welded seam, which is practically airtight and assists in making the speaking tube rigid and strong. The best



WESTERN ELECTRIC SPEAKING TUBE.

grade of tinned sheet iron, known as I. C. tin, is used in the manufacture. The sheet tin is thoroughly uniform and the tube when finished is not only uniform in regard to the character of the material, but also uniform in shape. Another feature is the careful manner in which the speaking tube is packed—200 pieces being put in a crate, which weighs approximately 152 pounds. The 200 pieces are equal to 1,000 feet. The size of a crate is 13¼"x17¼", and it is 5' 3½" long, being a convenient size both in weight and shape for one man to handle.

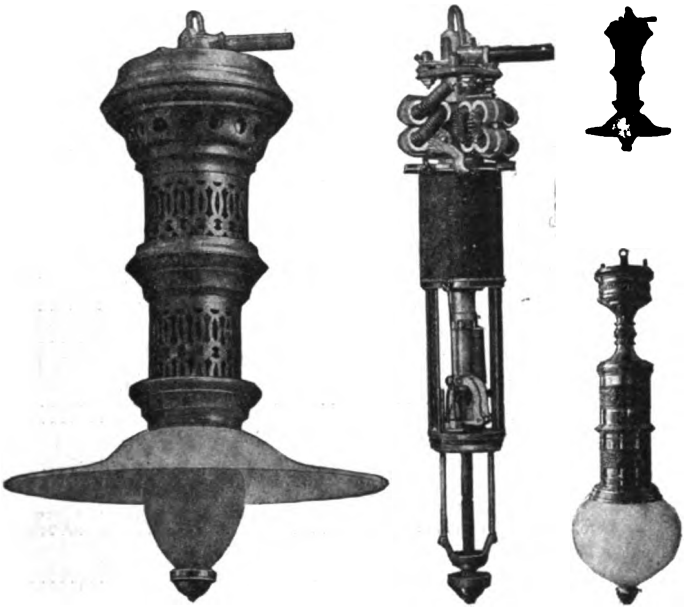
In the two illustrations are shown the method of making the lap-welded seam and also how the tube is packed when ready for shipping.

Digitized by Google

Miniature G. E. Enclosed Arc.

THE introduction of the enclosed arc lamp has extended the field of the arc system of electric lighting to interior illumination. The miniature arc of the General Electric Company provides for the use of the arc light in smaller units so that it may compete with oil, gas and incandescent lamps in illuminating halls, offices, display windows and rooms of limited area. In these new miniature arc lamps the illuminating power and the current are much less, so that several lamps are not more expensive to operate than one large lamp, while by dividing the total amount of light required the general illumination is greatly improved. The miniature arc lamp is also suitable for other places where a large arc lamp would supply more light than necessary. It is of the single globe and reflector type, the light of the arc being thrown down from the polished under-surface of the reflector.

This miniature arc lamp, designed for 110-volt direct current circuits, is frequently required to operate at slightly higher or lower voltages. An adjustable resistance has, therefore, been provided in the top of the casing which adapts the lamp to any line voltage from 100 to 120. The standard current required by the G. E. miniature arc lamp is 2½ amperes, but a loop in the magnet coil permits an adjustment for 3 amperes. Seventy-three to 75 volts are required at the arc, and when adjusted for 2½ amperes, with a line voltage of 110, the energy at the terminals is 275 watts. Adjusted for 3 amperes the energy is 330 watts. The life is from 40 to 45 hours with standard current and from 35 to 40 hours with 3 amperes.



FIGS. 1, 2, 3 AND 4.—G. E. MINIATURE ENCLOSED ARC LAMP.

The mechanism of the miniature arc lamp operates on the well-known General Electric carbon feed principle. The carbon is fed through a brass tube extending through the centre of the magnet coil. The double cam clutch, which operates directly upon the carbon, is simple in its action and has few parts. Special attention has been given to the design of the carbon holders and the general arrangement of the frame to facilitate rapid trimming. Figs. 3 and 4 show the striking contrast between the size of the miniature lamps and that of a lamp sold for interior illumination a short time ago.

The principal dimensions of the miniature arc lamp are: Length over all, 18½ inches; weight, 9½ pounds; upper carbon, 8½x⅜"; lower carbon, 3½x⅜"; enclosing globe, top diameter, 2"; maximum, top diameter, 3"; bottom, top diameter, 13-16"; height, 4"; porcelain shade, 11x2x2⅝".

No outer globe is used. Each lamp is arranged with a switch, so that it can be readily thrown in or out of circuit.

Several hundred of these lamps have been introduced among central stations in the past sixty days, and there seems to be an increasing demand for arc lamps of small and attractive design.

THE CUTLER-HAMMER MFG. CO. are kept very busy getting out their orders for motor-starters.

Jewell Resistance Rods.

A NEW form of graphite resistance rod is being used in large quantities by some of the largest telephone manufacturing and operating companies in the West. It is made by E. W. Jewell, 521 Wabash avenue, Chicago, and has some features that prove attractive to those desiring high resistance in a small space and for a small cost. The body of the rod is a non-conducting slate composition and on the surface of the rod the conducting layer of graphite is spread. This gives a large radiating surface and makes the rod able to dissipate a comparatively large amount of energy as compared with other forms of resistance occupying an equal space. Thus a rod of the size shown in the accompanying cut will continuously dispose of 8-10 watt with a rise of about 40 degrees Fahrenheit. Where more energy is to be dissipated, larger rods are made. They are regularly

JEWELL RESISTANCE ROD.

furnished in resistances of 50 to 5,000 ohms, though made higher or lower than this if required. Another feature that will be appreciated by those who have had dealings with graphite resistances is that the rods are furnished with metal lugs and terminals cast on the ends, as shown, so that a good contact is always assured. For ordinary commercial work, where low-priced rods are required, an accuracy of resistance within 2 to 3 per cent. can be guaranteed by Mr. Jewell, though if still greater accuracy is required it can be obtained at a slight increase of cost.

WESTERN NOTES

THE CUTLER-HAMMER MANUFACTURING CO., Chicago, report that their sales for August were larger than during any preceding month in the history of the company. This evidently indicates an increase in the business of the motor manufacturers, to whom most of their goods are sold. They are preparing for a large fall business.

STAR BRASS WORKS have been organized at Kalamazoo, Mich., with Dr. Van Zwaluenberg, president; G. M. Buck, vice-president; O. P. Johnson, secretary; H. P. Shutt, treasurer, and F. P. Crockett, manager. The works will make trolley wheels, electrical equipments, brass and aluminum castings, hardware and light iron specialties and models, etc.

THE CENTRAL ELECTRIC COMPANY, of Chicago, are headquarters for mica products, including mica sheets, mica segments, micanite segments, micanite cloth, empire cloth and M. I. C. compounds. These goods, in all the various forms and types, are carried in Chicago stock and can be supplied immediately.

ELECTRIC APPLIANCE CO. have just printed a special catalogue devoted exclusively to Anchor switches. This catalogue is fully up to date, embodying all the recent improvements that have been made in snap switches. The catalogue is supplied with a special discount sheet to the trade, and altogether makes a valuable little reference book on switches. It can be had for the asking.

K. McLENNAN & CO., of 100 Washington street, Chicago, sole manufacturers of the celebrated Gale's commutator compound, report that the increased demand and use of the compound has necessitated large improvements in their laboratory and they are now prepared to fill all orders without delay of any kind. Their manager stated to a representative of this paper recently that, while at this time last year they reported that nearly every user of a generator or motor was using Gale's commutator compound, it is safe to say to-day that every user of such machinery is unwilling to be without it. If, however, one can be found who has not tried and satisfied himself of the merits of "Gale's," a sample free can be obtained of any reputable supply house or of the manufacturers themselves. He further stated that the compound gives equally good results when used on collector rings.

THE CABINET MANUFACTURING AND SUPPLY COMPANY, an organization duly incorporated under the laws of the State of Ohio, with a capital of $20,000, succeeds the Cab-

Digitized by Google

inet Manufacturing Company, of Steubenville, O., and will continue business with its headquarters at Cleveland, O.

THE ELECTRIC APPLIANCE COMPANY have taken the general Western agency of the Utility Shade Company, manufacturers of the Utility shade in paper and celluloid. These shades are something quite new in the electrical line and are destined to find a very large field, as they possess a great many points of merit, among which may be mentioned the following: They are very light in weight, neat in appearance and practically indestructible. They require no separate shade holder and are low in price. They are made in a number of different shades and colors. The Electric Appliance Company have issued a special catalogue of these goods, which they will be pleased to send to the trade upon application.

WESTERN ELECTRIC COMPANY, which carries a complete line of iron armored conduit, has recently increased its stock of fittings for conduits.

NEW YORK NOTES.

THE WARREN-MEDBERY CO., manufacturers of inductor alternators, report a very large increase in sales for the month of August. They have made sales in the following places this month: Two in Canada, two in New York, one in San Francisco, one in Manitoba, three in Pennsylvania, one in New Jersey, two in New England, three in Texas, one in South Carolina, and one in Tennessee. The sales of this company are increasing rapidly, which would indicate that the popularity of these machines is greater than ever, and they are rapidly growing in favor with engineers and station superintendents.

STORAGE BATTERY SUPPLY COMPANY has been organized with T. D. Bunce as president and general manager and F. E. Foster as secretary and treasurer. The company is incorporated under the laws of New York State, with headquarters at 239 East Twenty-seventh street, New York City, where it will carry on a business in the sale of current and all various accessories of storage battery work.

GENERAL ELECTRIC STOCK. The committee of dissatisfied holders of General Electric preferred stock have instructed the American Loan and Trust Company to discontinue the pending suit against reorganization, as an agreeable proposition has been made to them of $100 a share cash on or before October 1, 1898, with interest from July 1 at 6 per cent. This amounts to $65 per share for the unreduced stock and five years' back dividends.

THE GARVIN MACHINE COMPANY, New York, report doing an excellent export trade. They are shipping large invoices to Germany and other European countries.

ADVERTISERS' HINTS.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., illustrate and describe the Wagner self-starting single phase induction motor. They say it is well adapted to meet the requirements of those single phase stations which have a call for power service but do not feel justified in a complete station equipment.

THE BEACON LAMP COMPANY, New Brunswick, N. J., offer to send samples free of expense to those desiring to test their claim that their lamps will average a maintenance of candle power at standard efficiency of over 300 hours and will have an average life of over 600 hours.

JAMES LEFFEL & CO., Springfield, O., state that recent tests at Holyoke enable them to guarantee the largest power ever obtained from a wheel of the same dimensions.

E. W. JEWELL, 521 Wabash avenue, Chicago, is manufacturing resistance rods of graphite by a new process. He says that there are thousands already in use by telephone companies.

D. VAN NOSTRAND CO., 23 Murray street, New York, advertise the "Electrical Engineer's Pocket Book," by Horatio A. Foster.

GEO. H. STOUT, 1208 Sheffield avenue, Chicago, advertises Crain's parhelion enclosed arc lamp. Each lamp is guaranteed for one year.

NEW ENGLAND NOTES.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., have the contract for furnishing the steel work for the Memorial Hall being erected at Westerly, R. I. This building is to be fireproof throughout, has steel floor beams and columns supporting the floor structure and steel trusses and beams for the roof.

HOLMES, BOOTH & HAYDENS, Waterbury, Conn., are making extensive repairs and additions to their plant. The Berlin Iron Bridge Company, East Berlin, Conn., have secured the contract for the steel roof work for the boiler room, 40x80 feet; the new muffle room, 35x80 feet, and the new brass mill, 118x90 feet. These new additions are to be fireproof throughout. The side walls are of brick, the roof supports are of steel and the covering of corrugated iron. The roofs are arranged with skylights for lighting the interior of the building and monitors for ventilation.

CONTENTS.

EDITORIALS:
The Recent Electric Lighting Consolidation in Chicago 314
What Becomes of Our College Graduates 314
The Waste of Current 315
The Isolation of the Farm 315
"Science Abstracts" 315

POWER TRANSMISSION:
The St. Joseph Sanitarium Electric Plant (illustr.)....H. B. Coho. 305
Electric Door Openers for Elevators (illustr.) 306

ELECTRIC TRANSPORTATION:
Cost of Electric Power for Street Railways at the Switchboard, Both Steam and Water Power (illustr.).....R. W. Conant. 307
Submarine-Accumulator Boat, Sandor Bak-Budapest (illustr.).... 312
The New York Central and Its Competitor "The Trolley"..... Orrin E. Dunlap. 312
Points in Track Construction 313

LITERATURE:
Isenthal's "Practical Radiography" 313

TELEPHONY AND TELEGRAPHY:
The Fire Alarm Telegraph System of Baltimore, Md. (illustr.)... C. B. Fairchild. 316
The Introduction of Hard-Drawn Copper Wire (illustr.)..... Thomas B. Doolittle. 317
Long Distance Telephone for the B. & O.—Mr. C. P. Bruch.... 317
Common Battery System for Chicago Telephone Exchange (illustr.).—Waiving Bell Telephone Commissions.—A Bell and Independent Telephone Combine in the Northwest.—Western Union Figures 318
The W. & C. Telephone Receiver (illustr.) 319

ELECTRIC LIGHTING:
Depreciation of Candle Power of Welsbach Mantles (illustr.)..... 319

MECHANICAL:
The Gear Cutting Work of Van Dorn & Dutton Company, Cleveland, O. (illustr.) 320

EDUCATIONAL:
Y. M. C. A. Classes 320

PERSONAL:
Mr. C. S. Sergeant (illustr.).—Prof. F. W. Chandler.—Lieut. T. H. Wood.—Mr. W. J. Clark.—Mr. J. G. Hickcox.—Col. Eugene Griffin, U. S. A.—Mr. E. W. Davis 321

SOCIETY AND CLUB NOTES:
Old Time Telegraphers at Omaha.—American Institute of Electrical Engineers 321

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents Issued September 20, 1898 322

REPORTS OF COMPANIES:
Details of the Westinghouse-Walker Consolidation 322
The Safety Third-Rail Electric Co. 323

THE STOCK MARKET:
A Good Fall Outlook 323

CATALOGUES:
Western Electric Company.—Columbia Phonograph Company.—The Taunton Snow Plows.—Central Telephone and Electric Company.—The Largest Dynamos in the World. 323
The General Electric Co.'s Literature at Omaha.—Electric Storage Battery Co.—Lehigh University.—Machado & Roller.—The Julius Andrae & Son's Company 324

TRADE NOTES AND NOVELTIES:
Fan Motors all the Year Round.—The Empire.—The H. & H. Push Switch (illustr.).—E. Phillips & Son 324
General Electric Magnetic Blow-Out Automatic Circuit Breaker (illustr.) 325
The Wheeler Porcelain Enamel Deflector for Street Lamps (illustr.).—Armorite Interior Conduit Company, Pittsburg, Pa.—Western Electric Speaking Tube (illustr.) 326
Miniature G. E. Enclosed Arc (illustr.).—Jewell Resistance Rods (illustr.).—Western Notes 327
New York Notes.—Advertisers' Hints.—New England Notes.—Foreign Notes 328

Department News Items will be found in advertising pages.

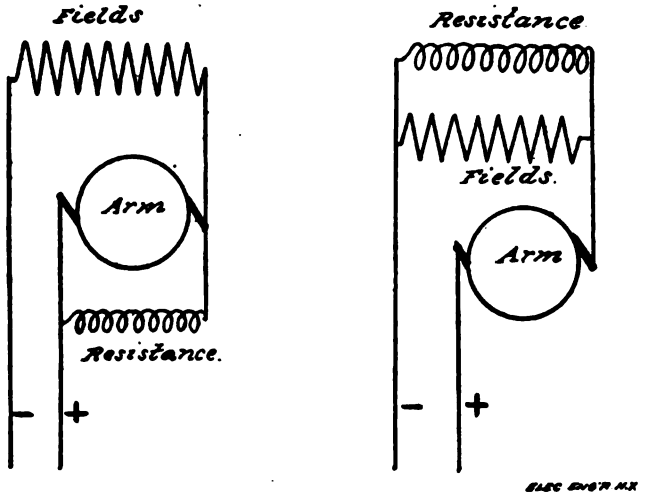
Digitized by Google

The Electrical Engineer.

Vol. XXVI. OCTOBER 6, 1898. No. 544.

Electric Dumb Waiters in the Chicago Public Library.

THE fine new public library of the city of Chicago is equipped with a system of dumb waiters for deliverng books from one department to another. These devices are operated by electric motors and there are some interesting things about the installation to the electrical engineer. The system is that of the



MOTOR CONNECTIONS.
FIG. 1.—DUMBWAITER GOING DOWN. FIG. 2.—DUMBWAITER GOING UP.

Burdett-Rowntree Manufacturing Company, of Chicago and New York, and six of the motors were furnished by the Northern Electrical Manufacturing Company, of Madison, Wis.

Most of these waiters travel simply in a vertical direction like an elevator, though some have recently been put in that travel in a variety of angles. The latter will be described later in this article.

The vertical dumb waiters for transferring books from one floor to another are controlled from any floor by the movement of a pointer. At each floor is a pointer on a semi-circular dial. The pointers on all the floors are connected together mechanically, so that if one of them is moved, all move. These pointers are intended to be moved by hand. The dumb waiter will come to whatever floor the pointer is placed at. If an attendant on the fifth floor wants the waiter at his floor, he moves the pointer to 5 and if all is right the waiter comes to his floor. If he wants to send it to the first floor, he moves the pointer to 1, and so on. To avoid confusion and accidents, the controller of the waiter motor is always locked when any door to the waiter shaft is open, so that the waiter can never be started when an attendant has the door open and is not expecting the waiter to start.

The most interesting electrical problem in connection with these waiters is the way the motors are arranged so as to avoid the necessity of counter-weights and at the same time insure a reasonably constant speed for the book trays. The motors used are series wound, about 1 h. p. in capacity and run when at full speed at the rate of about 500 revolutions per minute. Being of such small power and low speed, no starting resistance is used with them, but the current is snapped on at full voltage. In order to prevent these series wound motors from running away with the car going down heavily loaded, part of the current is shunted around the armature through a resistance, as in Fig. 1. This, of course, has the effect of so increasing the field strength by the greater volume of current passing through the fields that the counter electromotive force of the motor is very high for a given speed, and little current can flow through the motor. When the waiter is going up the connections are altered so that part of the current is shunted by a resistance around the fields, as in Fig. 2, which has the effect of weakening the field strength of the motor, reducing the counter electromotive force at a given speed and permitting the motor to run faster than with full field strength. Of course the resistance with which the armature is shunted is much higher than that used on the fields. The practical result of this electrical arrangement of the motor circuits is that the maximum variation in the time of ascent and descent of the waiter is only one second above or below an average of 17 seconds, or a variation between 16 and 18 seconds.

The connections of the dumb waiter motor and controller are shown in Fig. 3. The controller is operated by the movement of the pointers before spoken of. Moving the pointers to a floor number which calls for the ascent of the car throws the controller one way. Moving the pointers to a floor number which calls for the descent of the car moves the controller the other way. When a car reaches a floor for which the pointers are set the controller is automatically thrown off. This is done by mechanical apparatus not shown in the diagram.

The brake solenoid indicated in Fig. 3 is for the purpose of locking the armature shaft when the motor is not running. This solenoid acts to release the brake on the armature shaft whenever current is turned through it to supply the motor. Whenever current is shut off from the motor the solenoid allows the brake to set.

The wiring of the circuit is as follows: One main supply wire is connected directly to the outer brush of the controller. The other supply wire is connected directly to one end of the brake solenoid wiring. Whenever, therefore, a circuit is completed the solenoid is always energized and the brake liberated. When the pointer is moved so as to cause the car to ascend, the electric circuit is completed through the outer brush to the outer segment of the controller, from the outer segment to one of the brushes on the commutator of the motor, from the other brush on the commutator to the other segment on the controller. From this segment the circuit is divided into two branches. It can go through the inner brush of the controller to one end of the motor field circuit, through the fields, from the fields to the brake solenoid, and through the solenoid to the return wire. Or it can go through the extra brush (which is only in circuit when the car is going up) to the armature resistance, and through the "armature resistance" to the brake solenoid, where it joins the other current flowing through the solenoid to the return.

When the pointer is moved so as to cause the car to descend the circuit is completed as follows: From the main supply wire to the outer controller brush, from the outer brush to the other

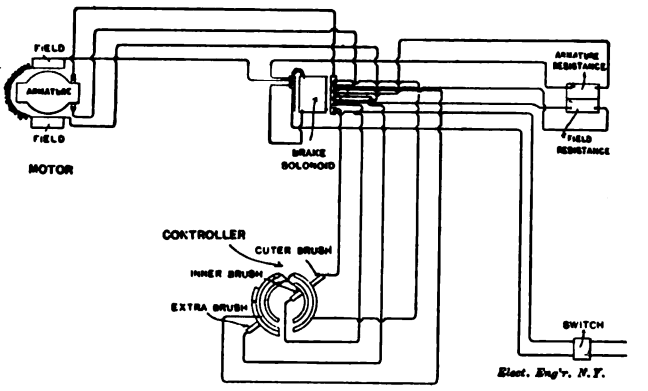


FIG. 3.—DIAGRAM OF WIRING OF BURDETT-ROWNTREE MFG. CO.'S ELECTRIC DUMBWAITER, INSTALLED IN CHICAGO PUBLIC LIBRARY.

segment of the controller and from there into two branches. The current can go either to one of the brushes of the motor, through the motor armature, from there to the other segment of the controller, to the inner controller brush, from the inner brush to the field of the motor and through the field to the brake

Digitized by Google

solenoid and out; or it can, instead of flowing through the field, flow through the "field resistance," and from thence to the brake solenoid and return.

Fig. 4 shows the motor winding drum and controlling apparatus for one of these dumb waiters.

In addition to the dumb waiters with vertical travel this company has also just completed the installation in the Chicago Public Library of what is probably the most peculiarly constructed book conveyor or dumb waiter ever erected. The conditions that had to be met and the obstacles that had to be overcome in designing this carrier made it necessary to devise several new and novel arrangements so that the operation of the carrier would be successful. The peculiar construction and arrangement of the building rendered it absolutely necessary that the path of the carrier should proceed from one terminus to the other along a line that curved and twisted in several directions. The carrier is for the purpose of conveying all the books that are delivered and collected in the sub-stations of the city from the stack rooms, where they are stacked, to the lower delivery room, from which point they are sent out over the city, and for returning them from the lower delivery room to the stack rooms again.

The conveyor starts a couple of feet above the floor of the lower delivery room and commences its travel by ascending vertically, then curves over to the north until at a height of about twenty feet above the floor it passes through the wall of the delivery room in a horizontal direction. An additional difficulty was met at this point, as the large opening that had to be made in the wall here was directly under a heavy marble column above. From this wall the carrier proceeds northward across a wide passageway, then through two or three janitor's storage and toilet rooms, then out through the outer wall of the building, through the upper part of the window (the window-casing having to be raised two feet and the window cut down to make room for the duct in which the conveyor runs). From this outer wall the duct makes a peculiar and complicated upward and eastward curve, entering the window of the stack room in a direction at right angles to that at which it issued from the outer wall of the janitor's room and at a point about six feet higher. The total travel from end to end is about 93 feet. The conveyor itself consists of two cars united by an endless cable and so arranged that when one car is at the limit of the travel the other car is at the other limit. It was only possible except in the centre part of the travel to make the duct of a size large enough to take a single car. The duct, therefore, is so arranged that where the cars pass each other it broadens out sufficiently to allow this to be done. Each car is hung in a steel frame in such a way that the car maintains its vertical position regardless of the position in which the frame may be placed. The frame itself is constructed

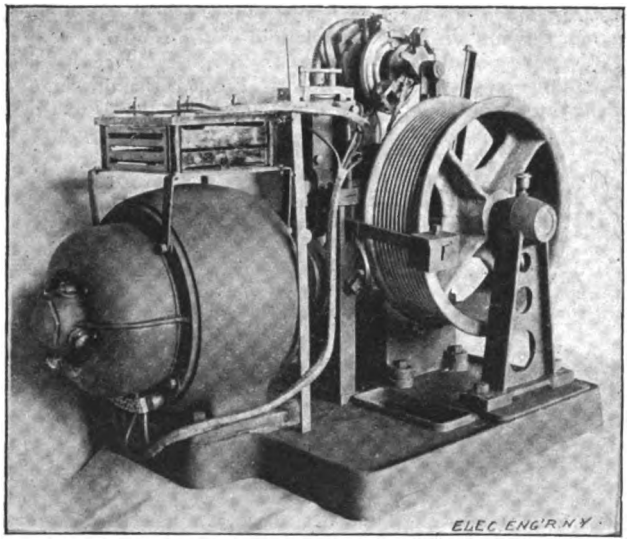


FIG. 4.—MOTOR WINDING DRUM AND CONTROLLING MECHANISM OF DUMB WAITERS.

of the best bicycle tubing, brazed together, and this in turn runs upon an upper and lower track in the duct. The rollers upon which this frame runs are fitted with ball bearings. Each roller is swiveled to the frame, and the two front rollers are fastened together and swiveled to the body of the frame in order that the frames and cars can pass around and over the different complicated curves in the duct. Every movable part of this frame is journaled in ball bearings. As evidence of some of the difficulties that were met with and successfully overcome may be mentioned the fact that in order to allow the frames to pass around

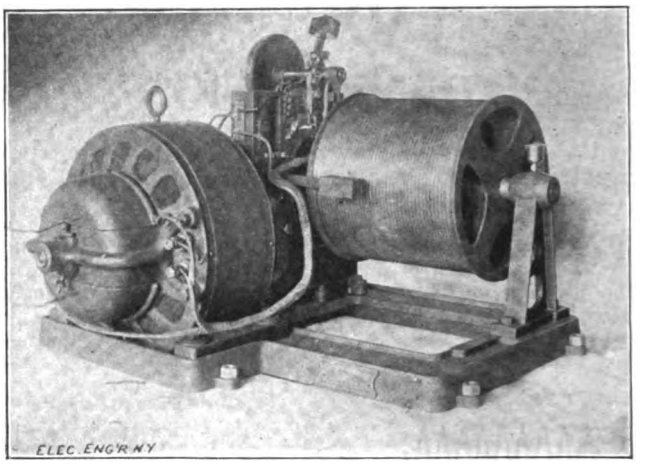


FIG. 5.—ELECTRIC DUMB WAITER HOIST IN CHICAGO PUBLIC LIBRARY.

some of the curves and in order to keep the endless rope from rubbing against itself on some of the curves, it was found necessary to raise one track above the other at several points and at other points to separate the tracks a greater distance than they were separated at other points. It should have been stated that each frame runs upon a separate pair of upper and lower tracks, the tracks being usually only a couple of inches apart except where they separate to allow the cars to pass each other.

The conveyors are operated by an electric dumb waiter hoist, shown in Fig. 5.

The hoisting mechanism, together with the tension sheaves are placed in the basement beneath the floor of the delivery room. The motor used in operating this mechanism is a 2 h. p. 110-volt, furnished by the Commercial Electric Company, of Indianapolis. The operation is controlled by means of two push-buttons at the upper end of the travel and by two push buttons at the lower end of the travel. It is impossible for either operator to start the cars until both operators are ready. The pressure of the button at one end produces no effect until the button at the other end is also depressed. The instant both buttons are depressed the carrier starts into action and the cars reverse their respective positions, stopping automatically by means of an ingenious snap switch when the limit of their travel has been reached. To again start the cars both the other push buttons have to be depressed.

It is estimated that this will handle 10,000 to 12,000 books per day, and the saving over the present system of hauling the books up to the stack room in boxes can be readily appreciated.

Lights Put Out by Miller Moths.

A special dispatch of September 17 from Jersey Shore, Pa., says: "From the great range of mountains millions of white millers swooped down upon this place last night. They bombarded in close formation every electric street light in town, and by midnight the place was in darkness. This morning thousands were found in every arc, which by their very force of numbers they had extinguished. In every section of this place the white wings of peaceful millers were spread like a mantle of snow. The millers are still out in force to-night. Williamsport and other towns were also visited by millions of millers."

DROUGHT ON THE LEHIGH. The Carbon Electric Railway, Mauch Chunk, Pa., have recently been unable to operate their trolley line because of slack water in the Lehigh River. Just now the Lehigh Coal and Navigation Company is shipping an exceptionally large amount of coal to tidewater by their boats, and this, with the low water, prevents the trolley company from being able to create power before 10 o'clock each day. The Westinghouse dynamos are operated by McCormack water wheels.

Digitized by Google

MISCELLANEOUS

Electrical Refrigeration.—I.

BY THOMAS J. FAY.

ANY new addition to the load of central stations must of necessity be of good interest to the management thereof, and as a matter of fact, if every meat market found adjacent to the "service connections" of central stations were to make application for power in quantity varying from 500 h. p. hours per month to 5,000 h. p. hours in the same time, then would the management of central stations find their load not only greatly augmented, but their light hour load materially advanced, because in the class of service required for refrigeration, there is absolutely no need to take power from the lines between the hours of 3 to 9 p. m., so that central stations could well afford to make a close rate for power, and marketmen being benefited thereby would unquestionably be willing to restrict their hours of operation to those not included within the range above cited. In order, however, that this question of electrical refrigeration may be more clearly understood, the writer thinks a description of such a system may not be amiss. In the first place, the title "Electrical Refrigeration" is a misnomer to the extent that refrigeration direct from the application of electricity does

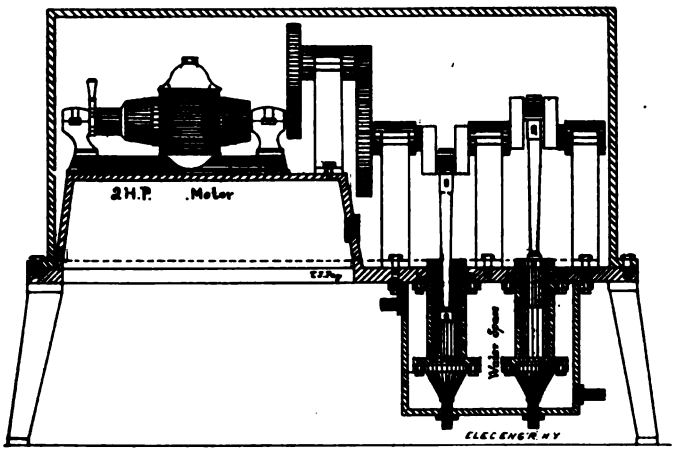


FIG. 1.—LONGITUDINAL SECTION OF FAY'S ELECTRICAL REFRIGERATING MACHINE.

not take place, in fact, a more comprehensive title might be "Electro-Mechanical Compression System of Refrigeration," because electricity is merely used as a motive power, and a compressor, driven by an electric motor compresses a suitable refrigerating medium of which there are several more or less suitable elements, such as ammonia (NH_3), sulphur dioxide (SO_2); Pictet fluid, [sulphur dioxide (SO_2) plus a small percentage of carbon dioxide (CO_2)]; and then again the carbon dioxide (CO_2) may be used alone, also methylic ether [$(CH_3)_2O$], as is sulphuric ether and atmospheric air sometimes employed for the purpose, to say nothing of chymogene, of which at present little is known respecting its qualities as a refrigerant. It is, however, as most people know, a petroleum product, and would, in all probability be debarred from use on account of its inflammability which, however, also applies to the ethers and debars them from use in all places, as New York City, where the laws respecting danger to life and property are stringent.

The other elements above mentioned, however, have not this drawback; on the other hand, carbon dioxide has too great a pressure corresponding to ordinary temperatures to allow of its use excepting under special conditions, as, for instance, aboard ships of war, where compactness makes up the sum total of important items, allowing that utility is not sacrificed to get the other benefit.

Atmospheric air is not over economical and is little used on this account, and therefore in actual practice refrigerating work is done nearly everywhere exclusively by ammonia, sulphur-dioxide or Pictet fluid. Ammonia mostly, Pictet fluid rarely, in America, because it is difficult to purchase in the open market, and seldom delivered twice in the same proportion of SO_2 and CO_2, which of course leads to complication, and is a great annoyance to users. Sulphur dioxide, however, is a

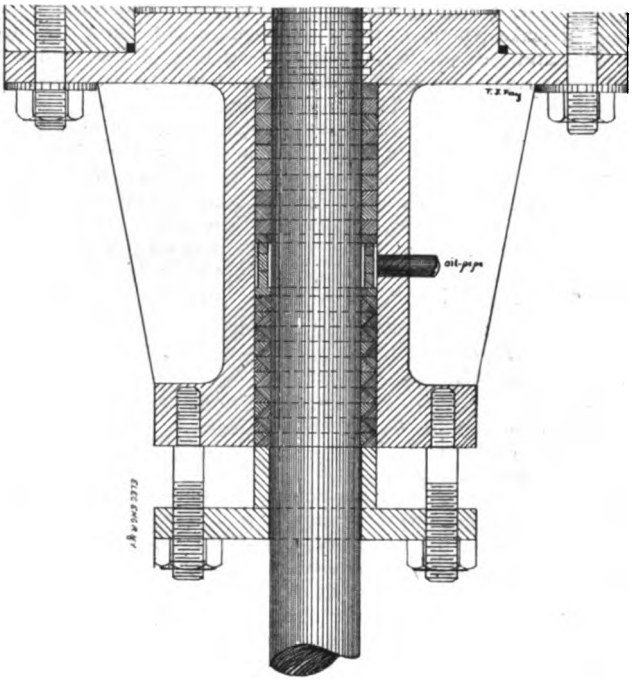


FIG. 2.—STUFFING BOX OF ORDINARY REFRIGERATING MACHINE.

stable mixture, easily obtained at about the same cost as ammonia, and aside from a most disagreeable odor it is an advantageous mixture, because its pressure at ordinary temperatures is about one-third that of ammonia, while its value as a refrigerant is adequate in all respects. The pressure and temperature of ebullition of these two refrigerants are given in the accompanying charts, Figs. 3 and 4, and by inspecting them an insight to the performance of these gases may be arrived at.

In order that a good insight into the design and arrangement of electro-mechanical compression systems of refrigeration may be gained, reference may be had to Fig. 1, representing a sulphur dioxide compressor with motor combined. This machine will not do for ammonia because that element combines with brass, bronze, copper and such other kindred elements,

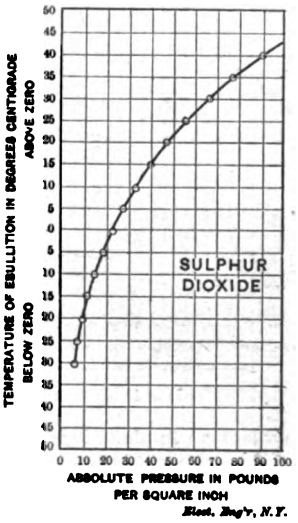


FIG. 3.

and would therefore promptly destroy the motor. Sulphur dioxide, however, has no such characteristics, and assuming the motor has no hard rubber bushings in its makeup, it will be preserved in the sulphur dioxide atmosphere which is chemically dry and a good insulator as well.

Digitized by Google

The apparatus, Fig. 1, is in general a cross-section of an outfit built about two years ago, and consists essentially of a 2 h. p. motor geared to a 3¾ inch by 8 inch duplex single acting compressor, and all enclosed within an hermetically sealed chamber, thereby obviating the use of a stuffing box, which latter device is a bar against the use of small machines, first, because of leaks which, in the absence of skilled labor, are unavoidable, and second, because a stuffing box of the kind required in refrigerating work takes power entirely in excess of that possible to afford. Thus, for instance, Fig. 2, showing a standard stuffing box for refrigerating machines, will take from three to eight horse power, depending upon how much leakage is allowed and the skill of the operator, whereas no leakage can be allowed at all in a meat market, and an operator is out of the question on small work because of the cost.

The machine illustrated in Fig. 1 has done good work through one summer, when the writer had an opportunity to note its performance, a test of which showed as follows:

TEST.

Speed of crank, 80 rev. per min.
Speed of motor, 1,800 rev. per min.
E. M. F. of supply, 230 volts (Edison circuit).
Current, maximum, 12 amperes.
Current, minimum, 8 amperes.
Current, average, 10 amperes.
Electrical horse power, maximum, 3.7 horse power.
Electrical horse power, minimum, 2.46 horse power.
Electrical horse power, average, 3.08 horse power.
Motor efficiency, maximum, 81 per cent.
Motor efficiency, average, 83 per cent.
Motor rating, 2 horse power.
Gear used, double reduction square cut, very noisy, about 80 per cent. efficiency.

AT AVERAGE LOAD.

E. H. P. to motor, 3.08 horse power.
B. H. P. of motor, $3.08 \times .83 = 2.55$ horse power.
Applied to gear, 2.55 horse power.
Delivered by gear, $2.55 \times .80 = 2.04$ horse power.
Applied to refrigerant, about 2 horse power.

RESULT.

The transfer of about 568,000 British thermal units of heat in twenty-four hours, or, in other words, the transfer of about the equivalent of two tons of ice netted; that is to say, one ton of ice equivalent per actual horse power delivered by the gas.

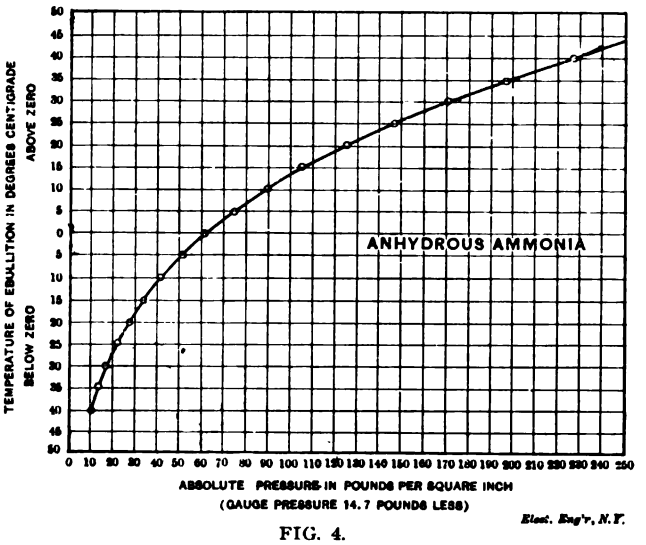


FIG. 4.

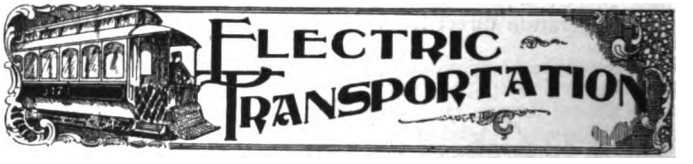
This, of course, involves an explanation, else the writer might be charged with having witnessed the performance of a perpetual motion machine. For, Joule's equivalent of one heat-unit is 772 foot pounds, and therefore, to realize a useful result of 568,000 heat-units from an expenditure of 2 actual horse power during 24 hours, would seem impossible. But, remembering that water is used for cooling purposes in the condenser, and tracing heat-units throughout the cycle, then will it be discovered that "The power furnished by the motor equals the difference between the whole number of heat-units and the number conducted away by the water and the surrounding air."

Now, assuming the atmospheric losses as nil, then in this case 568,000 B. T. U. of heat must have gone into the water, or, say, one gallon of water per minute per ton of refrigerating effect, say, 2,880 gallons of water per 24 hours for this machine, which means, when an equation is resorted to, that the water must have increased in temperature about as follows (the specific heat of water being unity), per ton of refrigeration

$$\frac{284,000}{1,440 \times 8.33} = 23.6 \text{ deg. F. increase.}$$

thus disclosing the place of disposal of heat units not accounted for by the motor. It is a fact, however, that water must be supplied to conduct away the heat-units given the gas by the motor as well, and it may be said with fair accuracy that the water circulated through the compressor jacket is more than adequate, not to mention the fact that the pipe surface exposed to the atmosphere does good work.

Of course, the quantity of water used simply depends upon how much the water used is increased in temperature; if the increase be great then is the quantity small, and vice versa; 30 degs. F. increase, however, is a maximum in practice, and if water be not costly, even 15 degs. F. increase is better, for then will the pressure due to temperature be reduced, and the power exerted by the motor reduced also. Furthermore, cold water is an important item, as an inspection of the charts before referred to will show.



The International Trolley Crossing at Niagara Falls.

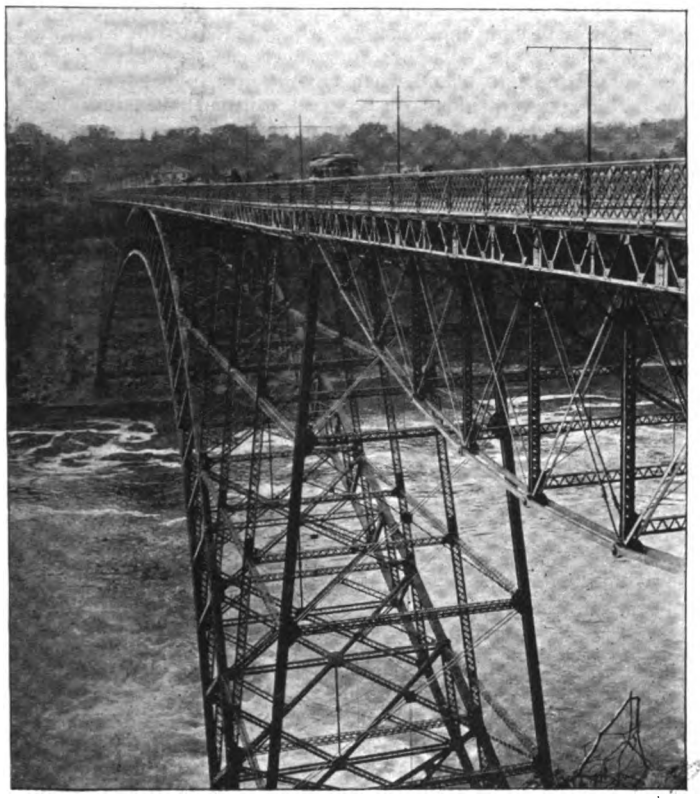
BY ORRIN E. DUNLAP.

THE Niagara Falls Park & River Railway has the honor of operating the first international electric railroad between the United States and the Dominion of Canada. This notable line is run across the greatest steel arch bridge in the world, which spans the Niagara gorge at Niagara Falls very close to the great cataract. The line has a double track, and the cars that are operated on the bridge connect at the Canadian end with the cars of the road running between Chippewa and Queenston, along the top of the high bank on the Canadian side of the river. On the bridge the centre pole system is employed and the cars speed across the structure every few minutes. Under the present arrangement the bridge tickets purchased by strangers allow them the use of the trolley cars; that is, they ride free if they so elect. Residents of Niagara Falls who pay 10 cents for crossing the bridge are forced to pay an additional 5 cents to ride in the cars, making the price for crossing the bridge in the cars 15 cents for both strangers and residents. The power for operating the cars on the bridge is supplied from the railway company's power station in Queen Victoria Free Park. This crossing of the steel arch by the cars of the Niagara Falls Park & River Railway places it in close business touch with the crowds of people in both of the great free parks at Niagara—the New York State reservation on the one side and the Queen Victoria Niagara Falls Free Park on the Canadian side. It is reasonable to suppose that all the people who go to Niagara sightseeing go to these beautiful parks, and therefore the advantages of the road for catching travel are extremely good. Then again, the New York State end of the line is right at Prospect Park, and its cars afford rapid transit between the free parks. The cars now run right up to the Riverway, a street within the limits of the New York State reservation. In time it is expected that connection will be made between the Niagara Falls Park & River Railway and some line on the New York State side, either the Niagara Falls & Suspension Bridge Railway Company or the Buffalo & Niagara Falls Railway, which could be accomplished by the construction of a few hundred feet of track up to Niagara street and across the Riverway to the tracks of the Niagara Falls Park & River Railway Company. The position of the New York State Reservation Commissioners has been always to oppose the construction of one foot of track on the reservation lands, but it seems likely that the present composition of the

Digitized by Google

board might not oppose the granting of the right to cross straight over the Riverway, providing the Legislature didn't object.

This new steel arch is of more than passing interest. The cliffs where it stands are 1,268 feet apart, and it is this space the arch occupies. The length of the main arch is 868 feet, and it is connected to the banks by two shore spans, one of which is 210 feet long, the other 190 feet. It is a single-deck bridge, having a width of 49 feet, 23 feet of the centre being given up to the trolley car tracks. On each side of the railway tracks are carriageways and walks, the latter slightly elevated above the floor of the bridge. The floor of the bridge is 192 feet above the surface of the water. The arch rests on four abutments, two of which stand at the water's edge on both sides of the river and are 67 feet apart. The Pencoyd Iron Works, of Philadelphia, built the bridge, which is the fourth structure erected on the site. The first bridge on the spot where the arch now stands was built in 1868. It was of wood, and in 1887-88 it was rebuilt in steel and made wider. On the night of January 9-10, 1889, this bridge was wrecked by wind. It was immediately rebuilt, and it is this



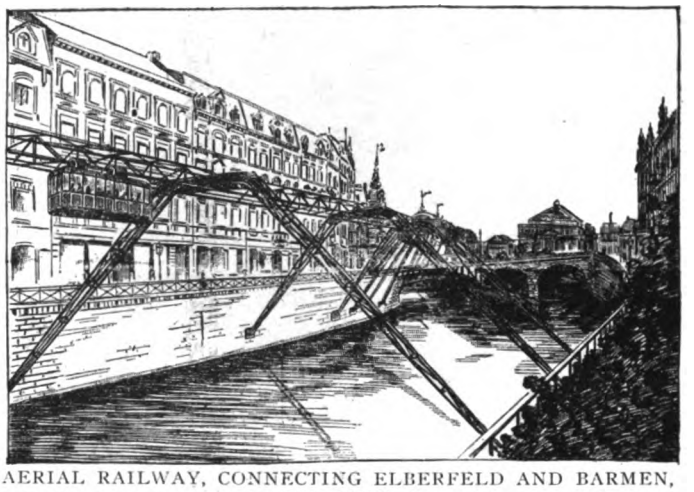
NEW STEEL ARCH TROLLEY BRIDGE, NIAGARA FALLS.

latter structure that gave way to the new arch, which, as stated, is the largest in the world of its class.

An Electric Aerial Railway between Elberfeld and Barmen, Germany.

THE two flourishing cities of Elberfeld and Barmen have for some time been connected by an electric street railway, which, however, has become inadequate to meet the growing traffic. The necessity for better railway facilities between the two cities has been felt for some time, and several years ago an elevated system was proposed such as the Siemens & Halske system, in use at the present time in Berlin. It was the intention to let this elevated system run over the river bed of the Wupper. As this ,however, required the erection of pillars in the centre of the river bed, and as the high water conditions of the river would have made the traffic dangerous, this project was abandoned. Just about that time the aerial system, "Eugen Langon," became known, and this seemed to be admirably suited for the case in question. It was, therefore, decided to install this elevated system, the construction of which is now, it is said, rapidly nearing completion.

Referring to the illustration, the inclined girders are placed 50 to 65 feet apart, according to the course of the river, and rest on specially constructed foundations on the bank of the river. They are held in this inclined position by means of girders at the top, which are connected with each other by a series of beams, to which the rails are attached. The entire line is eight miles long. For a small distance the inclined girders are supplanted by vertical ones. The stations are so arranged that they can be reached from



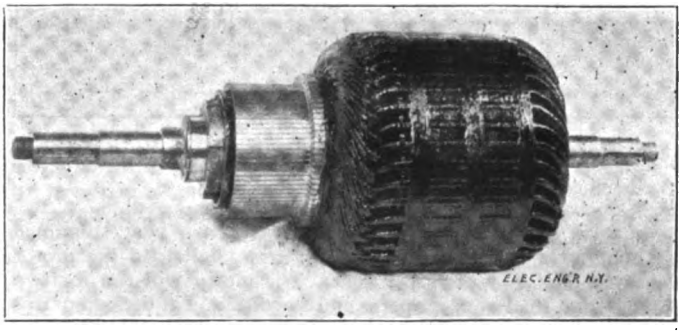
AERIAL RAILWAY, CONNECTING ELBERFELD AND BARMEN, GERMANY.

the Wupper bridges by means of a stairway. This divides them in such a manner that there is a station every 1,500 to 2,000 feet. The cars seat 50 to 60 persons and are suspended perpendicularly from rails attached to the longitudinal beams. The axles of the wheels are supported in movable trunnions, so that the long cars can be propelled with rapidity and without difficulty around small curvatures.

The safety of this system is greater than that of any other known system. The cars cannot possibly fall down, and in case of the breaking of an axle several clutch arrangements immediately come into action and counter rollers prevent too great a swaying of the cars. In laying out the system care was taken to build it sufficiently high, so that the lower edges of the cars are about 16 feet above the bridges to be crossed. The speed of the system, if electricity is employed, as proposed, is about 25 miles per hour. The cost of this two-tracked elevated system is estimated to be between two and five million dollars, and it will take about two years to finish it. The contract has been let to the Nürnberg-Maschinenbau-Aktiengesellschaft.

Horseless Carriage Motors for the Electric Vehicle Co., New York.

IN our issue of September 1 we gave an extensive description of the station and equipment of the Electric Vehicle Company, of New York, which embodied the details of construction



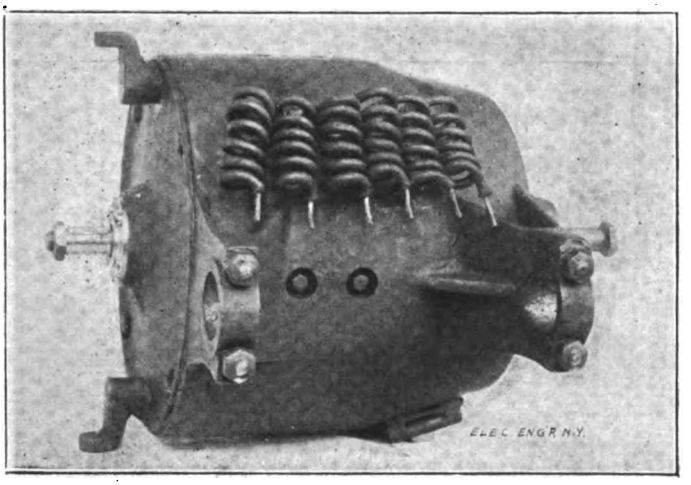
ARMATURE OF WESTINGHOUSE CARRIAGE MOTOR.

of the carriages, the station equipment and the methods for charging the batteries. Below we give additional data about the motors used for the vehicles, which were specially designed for this service by the Westinghouse Electric and Manufacturing Company.

They are 2 h. p. four-pole series motors, operated on 80 volts,

Digitized by Google

giving a speed of 800 revolutions per minute at 23 ampere load. The motors are entirely enclosed and are of the circular type. The field is made of cast steel. The poles, four in number, are laminated and are bolted into the frame. The shape of the pole is such that the field coils are held in position by the projecting



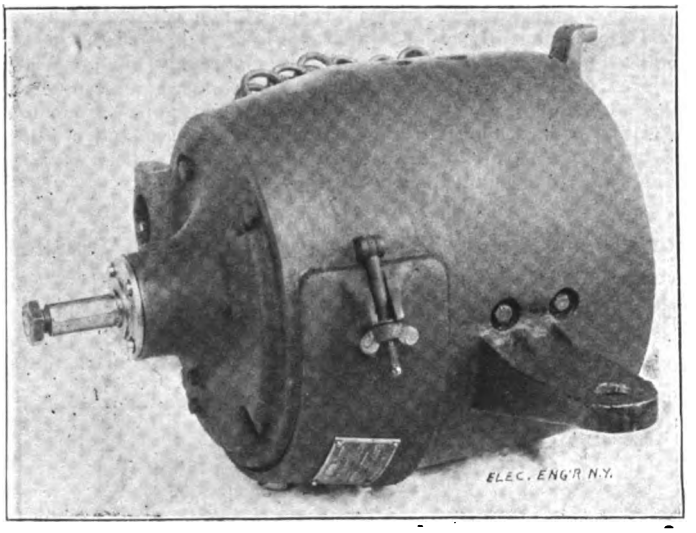
WESTINGHOUSE CARRIAGE MOTOR USED BY N. Y. ELECTRIC VEHICLE COMPANY.

pole tips, which are cast in one piece with the core, and embrace the armature over a considerable angle.

A slotted armature (41 slots), with ventilated winding, is used. The armature coils are all wound on formers, according to the standard method. The field coils are also machine wound, and they are arranged two in series, and these two sets in multiple. The wires from the armature and the two sets of field coils are brought out of the side of the frame and arranged in a row, thus:

Arm.	Field.
o o	o o o o

The motor gives an efficiency of 83 per cent. at full load, with



WESTINGHOUSE CARRIAGE MOTOR USED BY N. Y. ELECTRIC VEHICLE COMPANY.

23 amperes on motor. The maximum is 84 per cent., obtained at about three-quarters load. At 1½ times full load the motor shows an efficiency of 79 per cent. The motor will run for two hours with a load of 23 amperes and 80 volts, and at the end of this time the rise in temperature of any part does not exceed 40 deg. Cent. The accompanying illustrations show two external views of the motor as well as the armature.

STEPS AND STOPS. An ordinance has been offered by President Guggenheimer in the Municipal Assembly of New York requiring street cars to have steps not less than 8 or more than 9 inches from the ground. There are also provisions as to proper stopping of the cars.

By-Products of Power Plants.[1]

BY DR. M. M. FENNER.

I PROBABLY represent the smallest property and smallest capitalization of anybody here. I do not know but that I should blush to speak about our little affair after hearing representatives of great properties here. For instance, it was a horse road between Dunkirk and Fredonia that succeeded a 'bus line in 1866, and in 1891 it was converted to electric power. In 1893 we had our best receipts from passengers. Passenger receipts have been on the decline since. In that year they were about $23,000. The passenger receipts are a little less than $18,000. Some reason for that is that we have a pleasure ground half way between Fredonia and Dunkirk, the distance of which is three miles between the two towns, and that unfortunately got into litigation, and after 1893 was not used until it just got straightened out now. The bicycle business next came on and hurt us exceedingly, and then the City of Dunkirk is chiefly dependent on the great Brooks Locomotive Works, and a good many people live in Fredonia and work in Dunkirk, and since the panic of 1893 that concern has been running light, until recently, and the business fell off there. One of the chief sources of our receipts is the cemetery in Fredonia. Fortunately Dunkirk unites with us in the cemetery, which is located in Fredonia, except so far as the Catholics are concerned—they have one of their own elsewhere. And when anyone dies in Fredonia, who has perhaps never ridden on a street railroad, that individual becomes a good customer of the road, and it makes a great deal of difference to the railroad whether he is tenderly remembered or whether he is not; it makes a difference in the receipts. Well, you can see we have had to resort to other means. While our capitalization has been a little increased, although small now, at the same time we could not pay dividends on that, so we had to look into by-products, and what I have to say here is on exhaust steam, which has acted with us and still keeps us on a 6 per cent. basis. In fact, the road has earned 8 per cent. from the day it started until now—no matter what the capitalization was.

The past eight years has witnessed a practical conversion of the surface railroad mileage of the country from horse to that of electric power. It has also been a period of wonderful activity in the way of extensions and new construction of these roads. Patents and new plants for the manufacture of construction material as well as continual developments from the crude to the more perfect have rendered new construction expensive, while the enormous cost of conversion has added immensely to capitalization. These increased facilities have brought increased patronage, but not always sufficient in amount to give an adequate return on the augmented capital. This situation has made it incumbent on managements to look for further increase of revenue to meet the failing or decreased dividends. The establishment of parks, picnic grounds, dancing pavilions and other pleasure resorts has had attention, and in many cases brought most satisfactory returns.

The question of by-products of the power house has also received more or less attention, and under that head I desire to present my experience in a four years' utilization of exhaust steam.

During the year 1891 the Dunkirk & Fredonia Railroad Company changed from horse to electric motive power. The road is three and one-half miles long, with offices and power house situated centrally in the village of Fredonia, the village having a population of about 4,000. Its traffic is to the City of Dunkirk, having about 12,000 population, and to the Lake Shore & Michigan Southern and other trunk line railroads. It runs half-hour trains from 6 o'clock in the morning till 12 o'clock at night (midnight). Its capitalization while a horse road was $57,000, through fare 15 cents, with no debts and paying 8 per cent. dividends. During the legislative session of 1894 the company secured an amendment to its charter (which was a special charter granted by act of the Legislature of 1864). This amendment empowered the company to produce and sell light, heat and power to the village of Fredonia and also to the corporations and citizens residing or doing business in the said village; also, to rent such of its buildings as it did not require for its own use and supply its tenants with light, heat and power. The previous year (1893) the company had sold its exhaust steam for the purpose of heating the Hotel Columbia, a new and large structure being erected immediately across the street from the company's

[1]A paper read before the New York State Street Railway Association, September, 1898.

Digitized by Google

power house. This sale was in perpetuity and the consideration was $250 a year. By the terms of agreement with the hotel the company could only recover its exhaust steam by paying the Hotel Columbia the price of its plant ($2,700) required to convey the steam to the hotel and after a six months' notice. This hotel system was installed in the fall of 1893 and operated during the season of 1893-4. It was found to be a flat failure, and the railroad company was compelled to heat the building with live steam injected into the exhaust with sufficient pressure to compel a circulation. By the contract any live steam required was to be furnished at cost, and the company received $300 for the season on a settlement, which did not more than half make up for the cost. The contract specified that the exhaust steam was to be taken by suction in such a way as not only to cause no loss or annoyance to the railroad company, but that it would be an actual benefit, in that it would take off the natural back pressure incident to exhaust steam escaping into the air. It appears there is a heating system that proposes to do this. It was the representative of this system who acccompanied the hotel interest when the contract was arranged. But finally that system was not used, another one being installed without notice to the railroad company, which latter system required the operation of a 4 h. p. engine to pump the condensed water back from the hotel. The iron pipe in the system used was encased in vitreous sewer pipe, and by the time the system was ready to operate it was filled with water, making practically a condenser for the exhaust steam. The hotel contract had never actually been executed and the season's trial placed it out of the question.

The railroad company during the summer of 1894 began a search for further income to satisfy its new debt and increased capitalization, with a fare at the same time reduced one-third, or from 15 cents to 10 cents, and went upon an investigation of the different heating systems, of which it found several. We had already had sufficient experience with the one system connecting us with the hotel. We also appealed to the experience of others. I remember making a visit to the president of the Buffalo Electric Lighting Company, a business man of high standing. He told me his company had been in the business of heating for several years, but it was most unsatisfactory. He asked me to look out of the window and see the steaming ridge of earth crossing the street. He said that was his exhaust steam on its way to heat a building. He wished he did not have a contract left. He had lost a good deal of money at it, would not renew any contracts, had to heat all out-of-doors, etc. "No," said he, "don't try it. Get your money out of light and power or anything else, but don't try to get any out of exhaust steam. You may," said he, "succeed in heating your power station with it, but don't try to go further."

Now, I confess that this was a black eye. Coming, as it did, from one of Buffalo's brightest and most active business men, that temporarily set aside my hopes. I suggested that probably he had not selected a system of heating that would "insulate heat." I told him of the claims of the system I was then studying, made in that line, and I also told him of the notable failure of our hotel heating of the previous season, which I had laid to bad insulation and improper construction. But this had no weight. "His way was as good as any. The simple fact was, there was not any way of doing it so returns would be satisfactory." The heating company whose system I had under investigation then gave me references to companies where their system was in profitable operation, and I needed their encouragement after visiting Buffalo. Pursuing the matter, I got enthusiastic reports from Springfield, Ill.; Cedar Rapids, Ia.; Williamsport, Wilkesbarre, Scranton and Phillipsburg, Pa., as well as from the users of the Holly system, Lockport, N. Y.; i. e., its home patrons. The result was our company went on and had the heating plant put in and also an electric light and power plant during the summer and early autumn of 1894. The light and power additions to our plant made more exhaust steam, which, added to that from running the street railroad proper, gave a quantity sufficient for all the heat consumers we were able to get that year during the milder heating months like September, October and a part of November, also a part of March and all of April and May. During the remainder of the season the exhaust steam had to be reinforced from the boilers.

From a capital stock of $57,000 in 1891 our capital has increased to $116,200, and from the no debt of that period we have now a bonded 5 per cent. debt of $61,000. Also, our through fare was reduced immediately on the installation of electric power by one-third, from 15 cents to 10 cents, and yet we are able to pay our fixed charges and 6 per cent. on our increased capital. This is a showing that could not have been made had we not utilized our exhaust steam. In fact, our report to the State Comptroller has for several years shown 3 per cent. dividend from railroad, 3 per cent. dividend from manufacturing (which, interpreted, means sale of exhaust steam), making 6 per cent. in all, the last half coming from steam heating. The almost perfect system of insulation that we use enables us to market the by-product of exhaust steam in competition with anthracite coal, with all its cleanliness, conveniences and advantages. We sell it on a basis of $4.17 for best anthracite coal, and our consumers think it is fine and cheap. It is usually sold on the basis of $5 for anthracite coal. We sell by meter. Exhaust steam is no different from any other steam of equal pressure. The most economical pressure for heating purposes is understood to be from 4 to 6 pounds. When the exhaust steam is not in sufficient supply to give that pressure it is easy to reinforce it direct from the boilers to such a limited extent as needed.

Some of the questions we stumbled over were as follows:

1. How can we make heat at a pressure of 4 to 6 pounds circulate long distances and through a network of pipes in large buildings? We had the States Normal School to heat, having nearly 1,000,000 cubic feet of space, and other large buildings. In the Normal School they had been heating at a pressure of 40 to 60 pounds of steam by means of radiators in one part (direct radiation) and a fan driven by an engine (indirect radiation) in another part. The answer is: Condensation is all the while occurring in the pipes, diminishing space as 1,750 to 1, thereby creating a vacuum, which draws the steam on to fill it from atmospheric pressure.

2. How do you dispose of the water from the condensed steam? Answer: By letting it return at proper grade through the steam pipes to a cooling coil, from which indirect heat is secured, the cooled water finally escaping into the sewer. Or, if the building be too small for a cooling coil to be profitably employed, then it returns to the street mains and goes from them either directly into the sewer or passes into some heated building further down the line and through its cooling coil to the sewer after parting with its indirect heat. A special trap is indispensable to prevent the steam escaping to the sewer.

3. What effect will the back pressure have on your engines? Answer: No serious effect. The 6 pounds of pressure will neutralize 6 pounds of the 80 pounds of steam you run at. It will then require an additional pressure of steam equal to the back pressure in the pipe line, less about 1 pound—the amount of natural air pressure. If the back pressure was suddenly removed the effective pressure for the engine would run up a number of pounds equal to the back pressure, less the one pound for the natural air back pressure.

4. How much more coal will this back pressure consume? Answer: Not much; hardly noticeable in the coal pile. I experimented in 1896. Our large hotel, a consumer during the winter, wanted hot water in the summer. What would it cost? I wrote the Springfield, Ill., company for its experience. Our business in summer can be done with a 150 h. p. boiler. Springfield replied I ought to have $75 per month. But they would rather lose customers, and had lost them, than keep the steam in the pipes during the summer. I had the coal weighed at 1, 2, 3 and 4 pounds back pressure and compared with its weight when the exhaust went into the air. At 1 pound I found no difference, at 2 pounds I found a small difference and at 4 pounds it costs about $15 per month, with soft pea slack at $1.50 per ton. That was the price I fixed. But since that year we have metered it to the hotel with other consumers, and its cost is only about $6.50 to $8.50 per month. They need a pressure of from 1 to 2 pounds in the main, 4 pounds occasionally. We think it a benefit to the system to keep the steam in the pipes summer and winter. There is a little oil in the exhaust steam the separator does not remove, and it keeps the pipes and meters bright and clean, and the contraction and expansion are avoided. Most people like to take the chill off the air in damp summer weather and will use the heat if the meter is left in. We take meters off after the season is over for repairs and repainting, except when consumers desire to use some steam in the summer. In those cases we leave them on.

We have found the system profitable and most satisfactory in every detail. For instance, our State Normal School has never passed a winter without dismissing school more or less on account of cold days until we began heating them, and they have never had to close since for the want of heat. During the exceptionally cold season of 1895-6 Dr. F. B. Palmer, our principal,

Digitized by Google

told me his was the only one of fifteen normal schools of the State of New York that had not closed for lack of heat.

It having become quite widely understood that our company is operating successfully a steam heat plant, whereby it profitably utilizes its exhaust steam, much correspondence has been entailed upon me in explanation of the plant. It is therefore a relief to make a general statement at this time for all interested, which, it is hoped, will save much time in the future. The system that will insulate this by-product of power, exhaust steam, and permit its 960 units of latent heat, otherwise lost, to become available as it condenses into water, cannot fail to be a success if it will work. That it will and does work is abundantly proved by the experience of our company as well as that of a number of other companies that might be named throughout the country. As such I might name (some of whom rendered me important aid and encouragement by their counsel when in a state of doubt) the following: Springfield Electric Light and Power Company, Springfield, Ill.; Danville Gas, Electric Light and Street Railway Company, Danville, Ill.; Terre Haute Electric Railway Company, Terre Haute, Ind.; St. Joseph Electric Railway Company, St. Joseph, Mo.; Cedar Rapids Electric Light and Power Company, Cedar Rapids, Ia.; Electric Railway Co., Burlington, Ia., and many other plants unnecessary to mention.

The insulation consists of an iron pipe to circulate the steam. That is placed on rests 1 inch high, within bored logs, the bore being 2 inches greater than the pipe, so as to give 1 inch of dead air, the best insulator, all about the iron pipe, which latter is wrapped with asbestos. The log has a shell 4 inches thick, lined with tin which has been submitted to materials to prevent water-soaking and decay. This again is covered with three-ply tarred roofing felt and laid on a board at the bottom of a 5-foot trench. Expansion joints, or "variators," doing away with all packed joints, are inserted at proper intervals, with brick work built above them. Special protection is made at end joints of the logs where they fit into each other. The whole is then covered with earth specially tamped down, proper tile drainage being placed beneath the structure to take away all surface water. These are substantially the elements of the insulation and construction of the system we use, being known as the Holly System of Steam Heating, Lockport, N. Y. While this insulation is not absolutely perfect, it is practically so, and makes it possible to circulate the steam for long distances in proper sized pipes without "heating all out-of-doors," as the Buffalo business man consulted alleged to be the case. Mr. A. L. Ide, president of the Springfield, Ill., Electric Light and Power Company, wrote me under date of July 24, 1894, as follows: "In reply to your letter of the 17th inst. Our experience with the Holly system of steam heating, of Lockport, N. Y., has been entirely satisfactory. It has also proven satisfactory to our customers, and it has proven a profitable investment to us, as it does not require any additional labor or expense to keep it in repair or to operate it. We utilize the exhaust steam from the street railway engines from 6 a. m. until midnight. Our company has a contract with the city for lighting the streets, and we use the exhaust steam from the lighting engines from midnight until morning. Our plant cost about $40,000 and is bringing us in a revenue of about $10,000 per year, $8,000 of which, we believe, is clear profit. If your power house is located close to your customers, you certainly can make it profitable. We send you a copy of The Electrical Engineer, which gives a description of the plant."

This was among the evidence that induced our company to put in the plant. I. B. Smith, secretary Cedar Rapids, Ia., Electric Light and Power Company, has written me that their company put in the system of steam heating we use; that they have under contract the exhaust steam from another plant; that their power house is some distance from the point of distribution (over a mile), and that they are getting satisfactory returns on their $50,000 plant. In his letter of July 18, 1895, he says: "Our back pressure varies from 5 to 12 pounds, according to the weather, and we are able to carry steam to the extremity of our mains, the furthest point being somewhat over a mile from our plant, and to heat satisfactorily our largest blocks and buildings." He says further: "The steam is popular, clean and convenient and always to be had in abundance."

As previously stated, we pay 3 per cent. from our street railroad earnings proper and 3 per cent. from our steam heat earnings upon our whole capitalization. Thus, we owe it to the steam heating industry that our electric railroad corporation is on a 6 per cent. basis.

The growth of the heating business is shown by an increase of receipts from $2,800 in 1894-5 to $4,500 in the season of 1897-8. A satisfactory number of new customers have already made application to connect with our mains for the season of 1898-9. The heat is sold by the square foot of radiation, cubic feet of space, by meter, and at flat rates in the various localities where it is used. We adopt and prefer the meter. We think it would be as wise to sell gas and electric light on flat rates as to so sell steam heat. I can say with Mr. Smith, of Cedar Rapids, Ia., that the steam heat is clean, effective, cheap and popular, and always in sufficient supply. The amount of heating which a power plant may be able to do with its exhaust steam, can be closely approximated by the following rules, viz., that the exhaust steam from 100 h. p. engines when in use will heat 1,000,000 cubic feet of space in average buildings in the severest weather. This rule is believed to be substantially correct, and at the minimum rate of $3 per thousand cubic feet would amount to the sum of $3,000 per year. This method of heating is adapted to all kinds of buildings, whether dwellings, stores, offices, churches or public buildings. During the certain hours when the supply of exhaust steam may be insufficient there is a good profit in the supply of live steam with which the service is supplemented, for the reason, in part, that the men and boilers are already at hand, and it is better for them to be steadily employed than to be idle and unproductive a portion of the time.

DISCUSSION.

The President—Although Mr. Fenner says his is about the smallest road in the State, it occurs to me that the smallest road often requires better management to pay 6 per cent. than some of the larger roads. But in Mr. Fenner's paper he states that they lease power and so forth, and that is the little joker, I think. The large roads are unable to get special legislation whereby they can accomplish those effects.

Mr. Fenner—I think anybody could get legislation for heating purposes. We have no right to use power in Dunkirk, but we use it all the while because we are not in opposition to anybody. By common consent the City Council permits that. We could not use electric light.

Mr. W. J. Clark—The right of companies to do such business depends entirely on the provisions of their franchise or charter. Very frequently you will find in some cities that the lighting and the railway companies have combined. There are some very large instances, notably the Milwaukee Electric Railway and Lighting Company, which practically has control of all the street railways as well as of the electric lighting of the city. I think it will be found that in the New England States the electric lighting people generally have been very careful to see that electric railways did not generally get the right to do electric lighting. In the West a great many instances of that kind have been found. I think that wherever it has been tried in the smaller cities and towns—the combination of lighting and transportation interests—it has been found to work advantageously, producing economies which would be impossible in running two small systems independently.

Prof. R. C. Carpenter—I listened to the paper with a good deal of interest, and it has struck me that there were a good many conditions which might make the heating profitable, and again, in other cases, might not make it so profitable. One of those conditions depends very largely on the nature of your power. If you have an economical engine, a compound condensing engine of the best class, in which you can get a horse power from two to four pounds of coal on the one hand, and on the other hand if the engine requires six to ten pounds of coal as some do it would make a very great difference as to the amount of saving whether you can do the heating or not. With the economical engine you cannot save very much by the use of your exhaust steam heating or by exhausting into the air and use it in heating. With a non-economical engine, on the other hand, you could save a great deal. I think such conditions as these would have a good deal to do in deciding the question whether it is economical or not. Taking Ithaca, and also Cortlandt, N. Y., we have united the lighting with the railroad service, and in both those towns it has been very advantageous. I do not know how we could have kept our power house expenses in reasonable limits and made any sort of profitable showing unless we had them united. There was no difficulty whatever in making the necessary combination. In both cases it is a combination of two companies, however, rather than one company having two functions. But in neither place are the power houses situated so that

Digitized by Google

heating could be advantageously applied. In both cases we have got economical engines, and I do not think the gain would be very great even if we could use the exhaust steam for heating.

Mr. Cooper—Has Mr. Fenner made any experiments as to the distance that steam could be carried with economical results as to the percentage of loss per mile or so?

Mr. Fenner—I would say with reference to that, that we have perhaps a mile of pipe line, and there is not any part of the line any more than one-third of a mile away from the power house, so ours would not be a very good test. But at Cedar Rapids, Iowa, they run over a mile before they get to the point of distribution, and then heat satisfactorily. With reference to the practicability of steam heating, I think there would not be any difficulty of any railroad company in the State getting its charter amended so as to do steam heating. The people of the towns —the small towns particularly—would aid them as they did us. The village council of Fredonia aided us in getting our charter amended. We were not in competition with anybody, and where that is the case you can easily get it. But with reference to light in Fredonia, we happen to have very poor gas. The gas is made in Dunkirk and it was being drawn by a suction pump to Fredonia. That would let a little air in and we had villainous gas, so there was a great call for light, and the trustees wanted to buy electricity of me to make light. We had not any more right to sell them than we had anybody else, and we did not want to hurt the gas plant either. We went to the gas plant and asked if they would not put in an electric light plant. They did not care to, but said they would not oppose it. The trustees helped us to get our charter amended not only for heat, but also light, and as a matter of fact, it had the effect of taking some of the best customers away from the gas company and spoiled their plant, and about a year ago we bought it, so that we run gas now as well as electric light. The amendment to our charter did not state electric light, but simply said light, and we bought the gas plant. Now we run gas and electric light and steam heat and power. The power and the steam heat are not in competition with anybody. We bought the gas plant, so we are not in competition with anybody on that. I know you could not get the right to make light, but you could get the right to use each system. We could easily move our power house to the bank of a stream where we could have a compound engine the same as they had in Jamestown, the neighboring city. I have talked with them about this heat business. They thought they could not make anything out of it, because their power house is a quarter of a mile from the point of distribution and they use compound engines. We did not use compound engines at first because our plant was too small. It is large enough now to use compound engines economically. But there you only save, I understand, about 25 per cent. Now this exhaust steam is worth 100 per cent. So we could not afford to change, and if we were already changed we could not afford to operate. Some of the plants I have mentioned are not running with exhaust steam. Wilkesbarre is not running with exhaust steam, nor is Scranton. The same is true of Lockport. They run with live steam. Some of them go as far as two or three miles away. They make profit in selling live steam. Now, of course, if it would pay expenses to take live steam, the exhaust steam you have is worth its weight in gold. It is as good as 100 cents on the dollar, and we could not afford to use a compound engine and only get 25 per cent. out of it.

Prof. Carpenter—Just one other question regarding the loss which occurs from exhaust steam mains. I have made two or three tests of several existing plants in Cornell University that send steam half a mile from the power house in order to heat our buildings, and I have tested the losses which occur in that plant. I also tested a plant which the Lehigh Valley Railroad Company put in for handling coal a short distance west of here, in New Jersey, a few years ago. I found that with the best insulation the losses could be reduced to about one-fifth of what would occur if the pipes were exposed to the air and suspended above. Now you can usually count in ordinary conditions of weather and wind that about one-third of a pound of steam will be condensed in the air for each square foot of exposed pipe. You can insulate your pipe without excessive cost so as to reduce the loss to about one-fifth of that. That is pretty good insulation, however. A great deal of the insulation will not reduce the loss to more than one-third of what would take place. I think in that way we can figure pretty well what the loss is. I might also say that there are two companies in existence now who are doing exhaust steam heating and carrying steam a long distance at less than atmospheric pressure and making a success of it. So that it is entirely practicable and possible to do this kind of work without bringing an excessive back pressure on the engine.

Mr. Fenner—The back pressure does not seem to be any advantage if you run at 15 or 20 pounds pressure, on account of the insufficient radiation in the building, for instance. We did not gain anything by it. Five or six pounds will do just as well. It is not circulated by force from behind. It is circulated by the draft on account of condensation.

Prof. Carpenter—If the buildings are properly piped there is no reason in the world why there should be even one pound pressure. The heating is just as perfect with a pound pressure as with five or ten pounds. It is to overcome vertical resistance in the pipes in buildings that requires excess pressure.

The President—It is easy enough for the large roads to make their dividends, but for the smaller roads it is quite necessary that they have every opportunity for selling power, heat and light. On the statute books now there is a law that allows an electric lighting plant to build a railroad, I think, of twenty miles. But the moment a law is proposed whereby an electric railroad may sell light there is bitter opposition to the law. Another matter in that connection is the sale of power. They all claim, of course, that we have a return grounded current, and the insurance is immediately doubled or trebled, and that prevents us from selling power. We have on our roads sold a small amount of power. I think it would be very advantageous to the smaller roads if we could sell power. I do not see how we are going to do that until we get a metallic circuit.

Individual Fare Boxes.

MR. T. J. NICHOLL, of Rochester, N. Y., at the last meeting of the New York State Street Railway Association, reported his experiences with individual fare boxes and came to the conclusion that they were not desirable on roads with heavy traffic. He said:

"Summing it up, I find that the objections to the individual fare box are very much in the majority, the two things in its favor being, first, the saving of labor by conductor in having no reports to make out save the report of register readings, allowing him more time to the attention of his passengers; and second, whatever was dropped into the box, be it buttons, dead nickels or bad money, belonged to the company, and no opportunity is given the conductor to distribute the company's revenue according to his own ideas, both of which are of great importance, but not sufficiently so, in my opinion, to overcome the objections previously stated, and therefore its use has been abandoned by this company after using the same in the neighborhood of six weeks, during which time the men as well as the officials gave it a most fair trial.

"While it would seem, from the above, that the individual fare box is not practical in the operation of a street railway doing a large business, at the same time I am convinced that it would be a most excellent device for the use of lines with a light traffic, and would undoubtedly give them almost their entire revenue with very little expense for inspection, etc., which can hardly be afforded by such lines.

"This is my experience; I give it to the convention for what it is worth, and trust it may be of value to those who have had some idea of giving the system a trial. People have said to me that our citizens were too dishonest to admit of the system being a success in the United States. I don't believe one word of this and have not the slightest doubt that we could use them on the entire Rochester Railway without trouble, if we so desired, as it really is no reflection upon the honesty of the men; on the contrary, to an honest man it removes all possibility of suspicion.

THE MARCONI SYSTEM of wireless telegraphy was used recently with much success for a period of ten days between the royal yacht Osborne and Osborne House, Isle of Wight, numerous messages being exchanged between members of the royal family, Cabinet Ministers and others at the time of the Prince of Wales' lameness from accident. The distance was about two miles, with a high hill intervening. At one time, when the yacht was cruising, messages were sent a distance of seven and one-half miles. The results were carefully watched and proved highly satisfactory to all. It will be remembered that similarly successful work was done during a recent yacht race in Ireland.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1888.]

Vol. XXVI. NEW YORK, OCTOBER 6, 1898. No. 544.

The Photometry of the Enclosed Alternating Arc

THE perfection, within recent years, of alternating current generating apparatus and the wider introduction of the alternating current for all classes of service has had as a natural consequence a most wholesome effect on the experimental study of alternating current phenomena and the production of more efficient translating and current consuming appliances. Foremost among the latter is the enclosed alternating current arc lamp which now rivals in efficiency its prototype, the enclosed arc of the direct current type. At the hands of Marks and others, this lamp has been brought to a high state of perfection, aided by the scientific researches of such well-known men as Houston and Kennelly, Freedman, Hesketh, Nichols, Blondel and others. Little, however, has hitherto been published about the behavior of the alternating current lamp, its power consumption and light giving efficiency. Perhaps it is the lack of such data which gives additional value to the paper on "The Photometry of the Enclosed Alternating Arc," by Chas. P. Matthews, W. H. Thompson and J. E. Hilbish, read before the A. I. E. E., on Sept. 28.

In speaking of the subject of photometry in general as applied to the measurement of the alternating current enclosed arc, the authors state that the flat-ended carbons are due to the wandering condition of the arc. The opposite view, however, was held by Messrs. Freedman and Marks, who believe that owing to the exclusion of oxygen the carbons become flat and cause the flickering of the arc, which certainly appears to be a more plausible explanation of the phenomenon.

As it is necessary, in order to show the mean intensity of the arc, to take a large number of settings, which cannot be done with any degree of uniformity by the methods in use at present, the authors have contrived a mechanical device for recording a setting as soon as it is made. It is very ingenious and permits the observer to keep his eye continually trained on the photometer disc, so that all the major fluctuations may be readily followed and recorded, and this, too, without the visual fatigue resulting from introducing light into the photometer room. Another important point touched upon by the authors was that of the validity of the term "candle power," which they described as a derived quantity and of indirect significance. They use the Hefner unit throughout, which is highly commendable, but it appears that if that unit be used, the word candle power should be replaced by such expressions as intensity, brightness or luminous intensity. This naturally opened up the old discussion between candle power and luminosity, Mr. Marks claiming the two expressions to convey two widely different ideas. The former, he stated, was simply a standard of comparison, while the latter depends on the power to bring out an object, and the nature of the surroundings or the quality of the rays which go into the lamp. This view, however, was not shared by Capt. Millis, of the U. S. Lighthouse Board, who believed that if candle power was employed as a physical unit, luminosity being a visual, psychological impression, the two terms were of course quite different; if, however, both were considered expressions for physical measurements, candle power and luminous intensity were one and the same thing. Capt. Millis also pointed out the interesting fact that for commercial purposes a light was judged according to the brightness it confers on other objects, while for lighthouse work its quality depended on its own brightness, namely, the extent of the distance from which it is visible. He also remarked that in the service the alternating current arc lamp has given satisfactory results if good cored carbons were employed.

There is a great similarity between the polar diagrams for the direct current arc and those given by the authors, but the shape of the latter has been somewhat altered by the unsymmetrical bulb surrounding the arc and the greater reflection from the parts of the lamp situated just above the arc. On the whole the results of the tests are of great value, but they are, unfortunately not well suited for comparisons with the results obtained by experiments on direct current enclosed arcs, as in the latter clear instead of opalescent inner globes were used. Clear globes are certainly to be preferred, as the opalescent ones absorb much of the light. From the diversity of opinions shown and the doubts expressed as to the exactness and reliability of the results obtained by these diligent experimenters, it appears as if there is still great room for improvement in the theory and practice of photometry. Especially is this true in the measurements of arc lamps and those of the alternating type in particular in which many variable quantities are always present. But after all we are on the road to improvement and the words of Dr. Kennelly may serve as a consolation, namely, that the purchaser judges a lamp by an entirely different standard from the engineer.

The Application of Alternating Currents to Electric Traction.

THE hold which direct current now has on the operation of street railway cars is such that it would be rather difficult in future to displace the direct current motor from the car itself. But even now the alternating current is being called in at the transmission end of the electric traction problem, its domain ending at the sub-feeders, where rotary transformers convert the alternating current to direct. Looking at the larger problems in electric railroading which involve the changing of present steam roads into electric, much seems to be left to engage the attention of electrical engineers as to the best methods of tackling them. In recent numbers of the "Engineering Magazine" Messrs. Davis and Forbes carry out in a most extended manner the equipping of an electric road between New York and Philadelphia, one aspect of which they treated some time ago, and on which we made comment at the time. In the present instance the same authors first discuss in a general way the question of transmitting electric power from a waterfall or other "cheap sources" to a steam railroad by means of the alternating current, and the operation of such a road by electric motors. The conclusion which they reach as to the application of the alternating current directly on the cars is, we must confess, hardly encouraging. They assert in effect that the alternating motor, as constructed to-day, is not adapted to direct operation of railroad trains, either on the axles of the cars or at the head of the trains as a locomotive; first, on account of the difficulties in starting under load, and secondly, owing to the difficulty of controlling the necessary variations in speed. On the other hand, they consider that the alternating current can be better applied indirectly to railway operation, because of the facility with which it can be transmitted at high potential over long distances. It is a special case of the latter arrangement which the authors then fully discuss, and which is, specifically, the problem of a new road built for very high speed, with trains at frequent intervals, and comparing the relative first cost and operating expenses, assuming electric power to be obtained (a) from a cheap source at

Digitized by Google

a distance, with the corresponding charges, and (b) assuming the usual power stations located at intervals along the road. The authors take the oft-discussed case of a road between New York and Philadelphia, assuming several cases, among them two sources of power, each 100 miles from the line of the railway. They assume three-phase alternating current transmission at 20,000 volts, with 1,000 volts direct current from sub-stations to railway motors, with thirty sub-station rotary transformers. They also assume the road to have three tracks, trains of five cars each, with a three-minute headway, with trains 8½ miles apart, thus showing very high speed. Each train is not to require more than 10,000 h. p. at the station under economical conditions. The cost of such an equipment is compared against that of eleven power stations distributed along the line 8½ miles apart, including one at each end of the line, each supplying current at three sub-stations, with rotary transformers, with power stations to generate alternating current at 10,000 volts three-phase to sub-stations, where it is converted to 1,000 volts direct current to the railway motors. The other conditions being the same, it is assumed that the development of the water powers is to cost no more than the eleven power stations, which, in the authors' opinion, is highly unlikely, favoring the water power transmitted as against the steam power stations distributed along the line. In general, the authors state that every care has been taken to be fair to the distant source of power, and where there was any room for doubt the "cheap source" has been given the benefit.

It would take us too far to go into the details of the calculations, which are highly interesting, but the final conclusions reached are that the items added to the cost per car mile by the use of water powers located 100 miles away about balance the greater cost of fuel, water, oil, waste, repairs to power stations and power station wages. While, as stated, we cannot go into the minutiæ of the calculations, it may be interesting to note that the proposed transmission line is figured at $25,310,000, the copper alone amounting to $9,780.00.

According to the authors, the case discussed by them shows conclusively that it would not pay to utilize the water power. Against the objection to the assertion that this covers only one problem, they insist that the one chosen enables us to arrive at a general conclusion, since we are dealing with a very large amount of power at a comparatively short distance.

Granting that the calculations of the authors are fairly correct, and they have applied checks to them, we are bound to confess that we are not greatly surprised at the results. If 50,000 volts had been used instead of 20,000, as assumed, the cost of the copper would have been reduced to $1,555,000, a saving of $8,225,000, while if 100,000 volts had been used the copper would only have cost $390,000. But even that, according to the authors, would not have saved the day. This interesting calculation is well worth the study of all interested in this class of work. It must not be forgotten, however, that the distance of transmission assumed by the authors is 100 miles, and to that extent, of course, it is a special case. A shorter distance would make a material difference in the results, and we might suggest, as an addendum to their present calculations, one which should have for its object the determination of the distance at which transmitted cheap power can compete with power distributed along the road. It would also add much to the value of the solution of the problem here involved if the authors had considered the case where the energy is produced at the mouth of the coal mine instead of by water power. We might then have a direct comparison as between steam stations distributed along the road and a single concentrated steam plant. Besides, the latter condition of a coal mine available within a reasonable distance and even alongside the track of a railroad is a case of frequent occurrence.

Tornadoes and the Niagara Line.

A SERIOUS doubt was entertained by many people in regard to the transmission from Niagara to Buffalo, touching the ability of the pole line loaded with heavy conductors, insulators, etc., to stand up under the severe storms that blow across the lakes. A recent test, however, should give new confidence, if it had been necessary. Mr. Rankine, secretary of the Cataract Construction Company has just advised J. G. White & Co., who built the line, that the late terrific tornado which swept over Grand Island and Tonawanda left the line intact and without the loss of even an insulator. This storm caused much loss of life and destruction of property on both sides of Lake Erie, but the Niagara transmission continued without interruption for even a second. Such a result is very encouraging, for the wind rages with high velocity and free from obstruction across the plain on which the line runs, and the test thus imposed is about as severe as it could be made.

Wind Power as a Source of Electrical Energy.

OF all the natural sources of energy which might be harnessed for the generation of electricity there is perhaps none more unsteady and unreliable than wind power. To be sure, wind power is cheap and simple, but even these virtues do not compensate altogether for the above mentioned disadvantages, which have hitherto prevented its extensive introduction for electrical generating purposes. To solve the question how best to neutralize the inconveniences caused by the irregularity of the wind has been the most important practical point in connection with windmills, and for this purpose storage batteries and complicated automatic devices have been employed. Another method proposed has been to have the windmill pump water up to a tank, by which supply a water motor could be operated. In this way a constant head of water and speed of dynamo could be maintained. It has also been suggested that the windmill could be used to compress air in suitable reservoirs for operating air engines. Both of these methods were ably discussed by Mr. Rankin Kennedy, in the London "Electrical Review" of Dec. 21, 1894, and shown to be impractical in most cases. The latest device for neutralizing the irregularity of the wind, is the one devised by the well-known Danish scientist, Prof. La Cour, and called by him the Kratostate, by means of which, it is claimed, a windmill can very well be used for supplying power to a dynamo.

Prof. La Cour has for several years carried on a number of thorough, State-aided experiments, the results of which he communicated lately to a Copenhagen scientific society. He pointed out among other things the fallacy of the opinion that the greatest effort was obtained by horizontally moving wings, and he emphasized the importance of the suction on the lee side. With respect to the number of wings he found that a mill with sixteen wings had only one and one-third times as much power as one with four. In measuring the percentage of the power of the wind striking the wings which was absorbed or utilized by the latter, he arrived at the somewhat startling figure of 143.7 per cent. This unlooked for result was due to the above mentioned suction on the lee side of the wind passing between the wings. This as well as the shape of the wings were then taken into account in measuring the percentage of the wind power utilized, and it was then found to be 21 per cent. The absolutely best shape for wings has, however, not yet been ascertained.

This question of the utilization of the power of the wind is certainly an interesting and fascinating one, especially if we see it attacked by such a celebrated man as Prof. La Cour, and after Brush, Blyth and others have given us actual working examples of the successful installation of windmills. However, the field of usefulness will probably lie in the application in small installations, where mechanical or even electrical storing devices, sufficiently large to bridge over long periods of calm weather can be installed. In the words of Dr. Louis Bell, "It (wind power) must rather be regarded as a local competitor of distributed power, and even so in a small and limited field."

Exhaust Steam from Central Power Plants.

ONE of the most interesting and valuable papers read before the recent meeting of the New York State Street Railway Association was that of Dr. Fenner on by-products of the power station, with special reference to exhaust steam. The paper and discussion are fully presented in this issue, and will be found highly instructive. Dr. Fenner spoke from the experience of the Dunkirk & Fredonia road in this State, and showed a remarkable benefit to the finances of the company. The old horse road had had a capital of $57,000, but with the change to electricity the capital became $116,200, with a 5 per cent. bonded debt of $61,000. Under these new conditions, however, the road was steadily paying 6 per cent. on its stock, of which 3 per cent. came from the traffic, and 3 per cent. from the exhaust steam. These figures and others are explained in the paper, to which we would direct the attention of our readers.

Digitized by Google

ROENTGEN RAYS

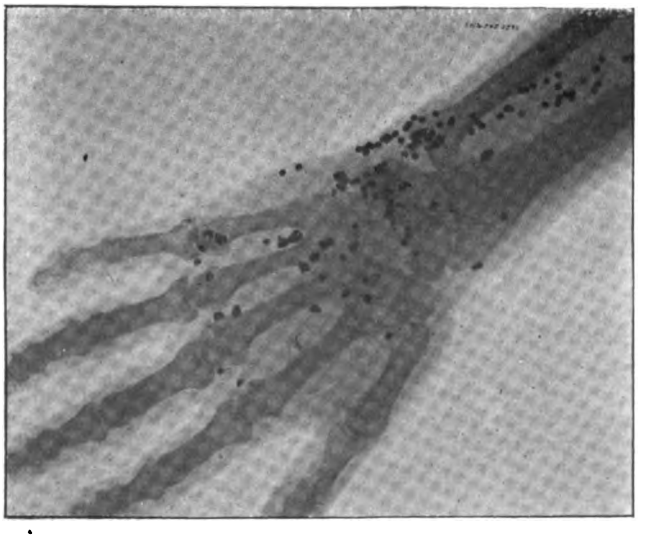
X-Ray Work in Baltimore.

BY C. B. FAIRCHILD.

LOYOLA COLLEGE.

ONE of the most enthusiastic operators in the line of X-ray work and also in the development of wireless telegraphy, is Father F. A. Tondorf, of the above college. This is a non-sectarian institution, but the professors are of the Catholic faith. Father Tondorf began experimenting with the X-ray apparatus soon after the discoveries of Röntgen were published, and its use is taught in the school in the regular electrical course. The apparatus used is that of the Edison type, with Lalande batteries, and he has taken some excellent photographs. One shows a needle imbedded in a hand and one of a double fracture of a boy's arm, which was taken through the splints. Father Tondorf has given more attention, however, to discovering the effects of the ray upon blind people, his subjects coming from a neighboring institution for the blind. Although some remarkable results have been obtained, they seem to be of little or no practical value to unfortunates of this class. A man whose eyes had been blown out by an explosion could detect the light instantly and tell the color of the light, but could not see objects, showing that the light rays affected the optic nerves. A boy totally blind and people affected with ametropia could distinguish the shape of objects like that of a horseshoe. It took some time for the shadow to develop upon his brain. It seemed to grow upon him after some seconds of exposure. Not one case of injurious effects upon the subject has been noted in this institution, and Father Tondorf thinks that none can come, except possibly in the case of a person affected with some skin disease, in which case he would advise caution, for the decomposing effects of the rays are about the same as those of a strong current, as is noted by its effects upon vegetable matter. In photographing he uses a seed plate in an ordinary plate-holder, with the tube placed about eight inches from the object, which rests upon the plate. Father Tondorf has given several public lectures on the use and effects of the X-ray, in which he uses lantern slides, which have been made from X-ray photographs, and sometimes after the lectures he asks people to come on the stage and allows them to examine their own bones by the use of the fluoroscope.

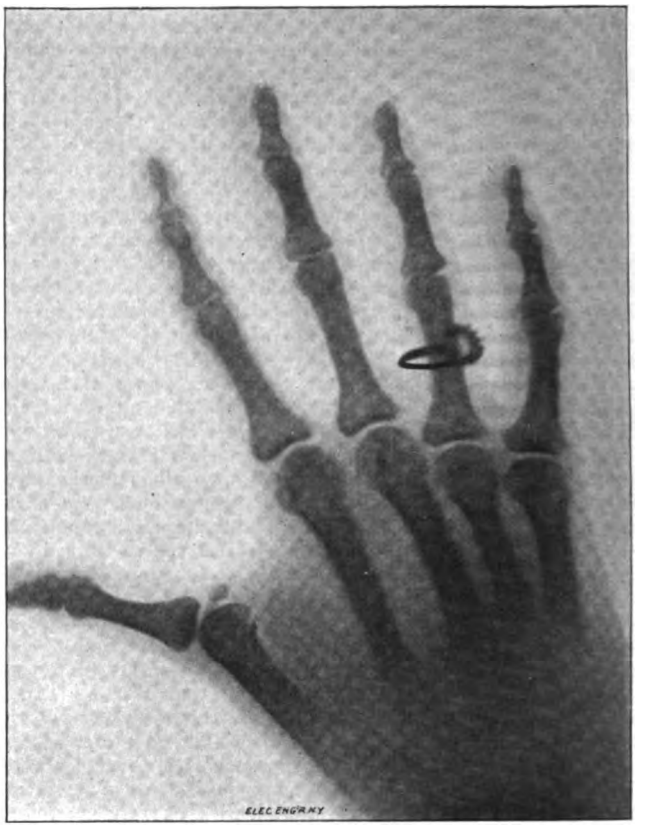
He is also an enthusiast on the subject of wireless telegraphy,



RADIOGRAPH OF HAND WITH 100 SHOT; NAVAL ACADEMY, ANNAPOLIS.

and has given public lectures and exhibitions with the apparatus for this purpose, and in practice has obtained some very interesting results, and proposes as soon as the instrument has been more fully perfected to telegraph between the top of the shot tower and the Washington Monument, two prominent landmarks, about half a mile apart, in Baltimore.

An interesting fact has been noted in these experiments, that the signals which were perfect from one side of the hall to the other before the audience assembled, and through the walls of the building, could not be repeated later, owing, it is thought,



RADIOGRAPH OF A WOMAN'S HAND WITH DIAMOND RING.

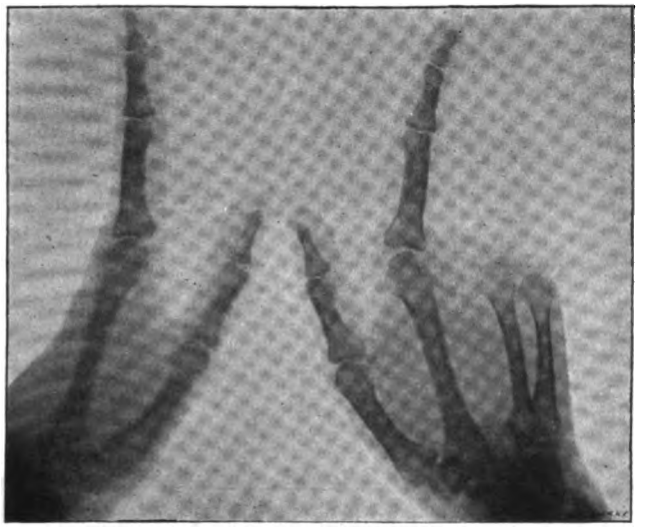
to the condition of the atmosphere in the room, and he is making experiments through gases of different kinds to discover, if possible, if they have any retarding effect. The signals are received as in ordinary telegraphy, with a distinct click, and an ordinary Morse key is used in giving the signal. At one of his public lectures on telegraphy, or rather at an exhibition given in the institution, wireless telegraphy was not only illustrated and described, but signalling, as employed by primitive man, was shown, including that by torches, flags, water tanks, on up to the means for submarine signalling. Father Tondorf says he looks for great and important results in the line of wireless telegraphy. He thinks, however, that the stray currents from the lighting and street railway circuits may confuse the signals in some cases, but does not think that messages sent in code from different instruments in the same region will in any way conflict with each other.

UNIVERSITY HOSPITAL.

Dr. Holland has used the X-ray to a considerable extent, as do the other physicians in this hospital, for examining fractures after they have been reduced and put in splints. They find it chiefly useful, however, for examining old and neglected fractures, where the patient was supposed to be well. They often find the exact relations of the fragments are not normal, and in some cases have been able to remove pieces of bone from old fractures that have proved annoying to the patient. The X-ray is used for locating foreign substances that may be lodged in the flesh, and the hospital receives several hundred cases a year where the removal of foreign bodies is necessary. In one case a bullet had lodged behind the skull and could not be discovered, the ray not penetrating the skull sufficiently to locate the bullet. A fine photograph of the bones of a hand is shown in which the shadow of a pin is distinguished that had been inserted under the skin in the finger, the photograph having been taken with the bone of the finger between the tube and the pin. It has been noted in the hospital practice that where a piece of glass is lodged in the flesh it made a heavier shadow under the X-rays than the bones or pieces of lead would make. No injuri-

Digitized by Google

ous effects have been observed in the use of the X-ray in these cases, and no serious accident has occurred in its use, the voltage employed being only 110. The chief expense in keeping up the apparatus is found to be in the renewing of the tubes, as the vacuum gets low after a time, and occasionally the glass



WOMAN'S HAND, AFFLICTED WITH RAYNAUD'S DISEASE. EXPOSURE 8 MINUTES; JOHNS HOPKINS HOSPITAL.

is punctured from sparks through careless handling. No practical use is found in the use of the X-ray examination of the lungs or the location of tumors other than bone tumors.

The University Hospital is a State institution and has accommodation for about 250 patients. Chronic cases are not received. There are 60 beds for use by city patients and 24 for the State, there being one for each county. The institution is equipped with a private telephone exchange on the Home system, every floor and ward being connected.

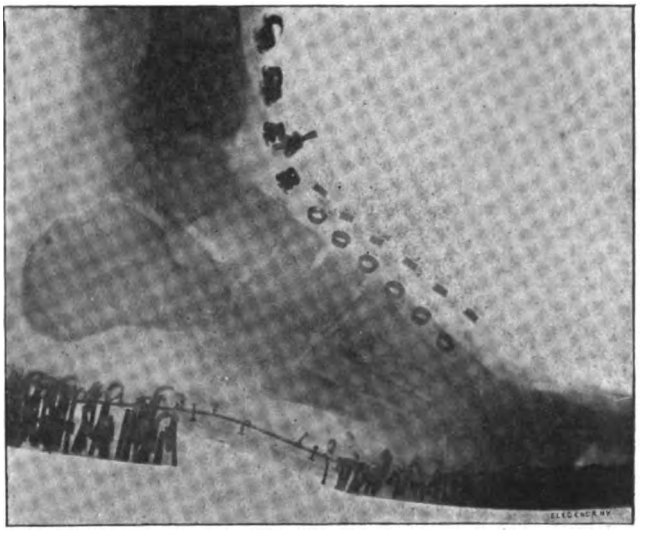
JOHNS HOPKINS HOSPITAL.

An X-ray machine is in almost daily use at this institution and is not only used for locating foreign substances and for studying fractures in new cases that come in, but is employed for inspecting the condition of convalescents before they are discharged and for examining old fractures where they are giving trouble to the patient. A special room is fitted up for the X-ray work and a storage battery of five cells furnishes the current. The tube is mounted on a portable cabinet, but the secondary coils are placed upon an adjoining shelf. A high canvass cot mounted on castors is provided, on which the patients are placed and which is readily adapted to any position, so that the tube may be placed underneath or on any side of the body. The instrument is operated chiefly under the direction of C. A. Penrose, M. D., one of the house physicians, and is considered by him an almost indispensable adjunct to a hospital equipment. It is not found to be of much use, however, in examining tumors, except where there is an osseous deposit, nor in studying the internal organs, although a shadow of the patient's heart has been obtained in one of the photographs. No injurious effects have been noted from the use of the rays in this institution, and the doctor is of the opinion that where injurious effects have been reported it has been due more to the vibratory effects of the current than to the ray. The doctor advises caution in the use of the ray for locating foreign substances in the flesh, especially if imbedded deeply, on account of the perspective, and advises looking at the object from different angles, otherwise the cutting may be done in a wrong direction. The practice here is to carefully locate the object with the fluoroscope from different directions, when the necessary computation is made for correcting the error in the angle of deflection. In making photographs an ordinary seed plate is used, and these are placed, still within their envelope, in position to receive the shadow of the object. The accompanying illustrations are reproduced from photographs taken by the instrument in this institution. One is of a person's foot, with the shoe in which the buttons and nails in the soles are readily distinguished. The other is of a hand in which some of the bones are wanting.

F. R. ARNOLD & SON.

To the enterprise of this firm (dealers in surgical appliances and electric medical supplies), located at 15 Hopkins Place, is due largely the introduction of the X-ray apparatus into the public institutions, hospitals and among the medical fraternity of Baltimore, and there are now more than a dozen equipments, including the Hospital Department of the Maryland University, College of Physicians and Surgeons, Baltimore Medical College, Johns Hopkins Hospital, Maryland Homeopathy Hospital, Loyola College, and others among the practising physicians, several of which are described above. Arnold & Son keep a fine cabinet instrument always ready for exhibition at their store, and very frequently physicians bring cases to them for examination. The apparatus sold by this firm is that made by the Edison Manufacturing Company, and the batteries are of the Edison-Lalande type. Some of the machines owned by physicians are operated by a static current. Some have attempted to employ current from the lighting and street railway circuits, but have not succeeded in cutting the voltage down to make it practicable, the best results being obtained with a current of about 110 volts. When the method was first introduced an expert was sent on by the manufacturers. He remained for some time giving exhibits, both with the fluoroscope and by photograph of the results obtained by the use of the X-ray, and in this way created quite a demand for this apparatus. Some very good photographs have been obtained. Among them is a lady's hand, with a diamond ring on one of the fingers, as shown in the accompanying illustration. It is interesting to note in this connection the already recorded fact that the shadow of the bone shows through the setting of the ring, showing that the rays are not reflected by a diamond as they are by a piece of glass. It has been found that an ordinary piece of glass, when imbedded in the flesh, casts a shadow more dense than bone, wood or lead. For this reason it is claimed that the X-ray is the best means by which the genuineness of a diamond may be ascertained. Fractures can be photographed through wood, fibre or rubber splints, but not through those of metal.

Only one case of injury from the effects of the ray has come to the notice of the above firm, and this was a person whose hands were burnt after repeated and continuous exposure to the ray. It is claimed that no injurious effects have been noted in ordinary practice. There is not, however, so great a demand for the instrument among practising physicians as formerly, as there seems to be but little to be gained by the use of the rays for therapeutical work, as all the vital organs as well as the flesh are rendered transparent by its use, and only the shadow of bones or tumors on the bone, or some foreign body, can be located,



RADIOGRAPH OF A FOOT AND SHOE, SHOWING NAILS AND EYELETS; JOHNS HOPKINS HOSPITAL.

Instruments in cabinets of the above description are sold at from $200 to $300 each. If properly cared for they do not readily get out of order, and this instrument, now in service for more than a year, has never required any repairs.

Digitized by Google

LETTERS TO THE EDITOR

The Recent Strike in the Bullock Factory.

ON the 18th of March of this year we had a strike of our machinists, which you mentioned in your journal, and to which you have referred once or twice since. This strike has just been declared off, and as the strike was occasioned by the men fighting for the matter of principle and not for the amount of wages involved, nor hours of labor, it might be of interest to manufacturers in general to know the result of this six months' strike.

The strike was against the introduction of the piece work or premium system in our factory. The system which we employ is practically a premium system and men are paid by the piece, but piece work prices are so arranged that the average workman can earn as much, if not more, than his day wages. If any man regularly falls below the amount of work done by the average man, the assumption is drawn that he is not as good a workman as the average, or that he is careless or lazy and his regular daily wages are lowered or his services are dispensed with altogether. Our machinists objected to this system and struck on account of it, although we believe a good deal more than the majority of the men who went out did not understand the system which we expected to adopt nor exactly why they were striking, but were led into it through their labor unions and labor agitators.

Our former employees have called upon us a number of times within the last two months, making us propositions to take them back, and we finally agreed to take them back—as we had vacancies which they could fill—they agreeing to work under the system under which we have been running our factory and on account of which they struck.

The result of the strike seems to have been the total loss of wages to the strikers during the last six months and probably a gain of experience on their part, and considerable annoyance on our part, although it is interesting to note that we were able to fill the places of our strikers, and we did more business within the last six months during the progress of the strike, by several thousand dollars than ever before in the history of the company. It is however, not a particularly easy nor profitable way to obtain more business by bringing on a strike, and we should not advise our fellow manufacturers to attempt to increase their business by such methods.

THE BULLOCK ELECTRIC MFG. CO.,
J. S. NEAVE, Vice-President.

Cincinnati, O., Sept. 24, 1898.

Easy Testing of Arc Light Circuits.

I READ with considerable interest the articles entitled "Testing Arc Light Circuits," by Mr. Markland, in your issues of September 8 and 22, and would say that I thoroughly agree with him in the advisability of every central station employing series arc lamps making use of a high range voltmeter for the general purposes indicated.

For something over a year I have advocated the use of a high range voltmeter capable of reading the total potential of an arc light dynamo, and so arranged that, by properly connecting it in circuit, not only the total e. m. f. of the dynamo or circuit may be read directly in volts, but also the presence of a ground indicated and the location of the ground determined. Such an instrument has been placed on the market by the Keystone Electrical Instrument Company, of Philadelphia. It was first publicly presented at the meeting of the National Electric Light Association held in Niagara Falls in September, 1897, and since that time very extensively introduced in the larger electric light stations throughout the country.

In using these instruments, in accordance with the instructions sent with each, all the tests suggested by Mr. Markland may be made directly without complicated calculations or the use of a slide rule, and any switchboard attendant capable of performing a simple sum in addition and multiplication can place the direct results of the test on his log sheet. All the readings of the instruments are given directly in volts, and the total calibration carried to the maximum potential of the machine or circuit for which it is designed, so that there is no necessity to employ a multiplier or correct the readings of the voltmeter by the ratio of the multiplier to the voltmeter itself. In addition to this, the instrument is fitted with plug switches and receptacles self-contained in the case, so that by connecting the binding posts to the spare test cups, with which every arc light board is equipped, direct readings in volts can be obtained of the potential at the terminals of the circuit and the ground reading from either plus or minus side of line to ground. These three readings properly equated determine absolutely the location of the ground between any two lamps in the circuit, and, by using in connection with these values the resistance of the instrument, the absolute resistance between line and earth can be determined. This latter result enables the superintendent to determine the general character of the ground.

I believe the whole subject of properly testing arc light circuits is one of growing importance and will, in the future, attract the attention of the central station managers to a greater extent than heretofore; therefore, I am taking the liberty of calling your attention, and, through your paper, the attention of your readers, to an instrument which has been especially designed for this class of work and, which, I believe, meets fully the requirements of the case. J. F. STEVENS.

Philadelphia, Sept. 24, 1898.

TELEPHONY AND TELEGRAPHY

An Arrest by Telephone at New Brunswick, N. J.

A special dispatch from New Brunswick, N. J., of Sept. 26, says: Locked in a bank building, unable to interfere, C. W. Caltner, early this morning was compelled to passively witness a murderous assault with knives committed upon two men, one of whom will probably die. Modern science, however, aided the man in his exciting predicament, and he was enabled to summon the police by telephone in time to prevent what might have been a double murder and to secure the arrest of the aggressors.

Caltner is employed as watchman at the New Brunswick Savings Institution, at the corner of George and Church streets, this city. Each night he is locked in the building, and it is impossible for him to get out until relieved at 7 o'clock in the morning. Caltner was looking from the window of the bank at 3 o'clock this morning, when just outside, not ten feet away from him, four men stopped and got into a fierce altercation. Suddenly two of the men drew huge knives, which gleamed in the light of the lamp at the corner, and furiously attacked the other two.

The watchman at the window shouted at the top of his voice and frantically endeavored to arrest the attention of the men who were doing the stabbing, but the unequal fight went on with increasing fury and the horrified watcher believed himself doomed to stand powerlessly by while murder was being done. Suddenly he remembered the telephone, and hurrying to the inner room, he called up police headquarters and briefly told of what was going on.

The sergeant and two policemen immediately dashed out and within two minutes arrived, just in time to catch the two men who were running away. The other couple were found bleeding and unconscious on the sidewalk. Caltner watched the arrests and the carrying away of the wounded men in an ambulance, from the windows of the bank, and shouted that he would go around to the police station as soon as he was released from his imprisonment in the building.

PHILADELPHIA. The Board of Directors of the Bell Telephone Company have ordered an immediate issue of $500,000 of the increased $2,000,000 capitalization authorized by the stockholders. The balance will be issued from time to time as the requirements of the company demand. Secretary Huey states that the business of the company had increased during the past three years from 4,012 subscribers to 8,050, and was still growing, requiring an almost constant extension of the system. The new capital will be used in wiping out an indebtedness of about $100,000 on the new building at Eleventh and Filbert streets and in paying for extensions now under contract.

Digitized by Google

ELECTRIC LIGHTING.

Switchboards in New Buildings in New York City.

WE illustrate herewith a switchboard, Fig. 1, which has recently been installed in the Franklin Building, Murray street, New York, as worthy of mention owing to the many new apparatuses used and the novel features combined with the latest improved construction. This board was manufactured and installed by F. A. La Roche & Co., Thirteenth and Hudson streets, New York City, Messrs. Clinton & Russell being the architects and Messrs. P. M. Mowrey & Co., the electrical contractors.

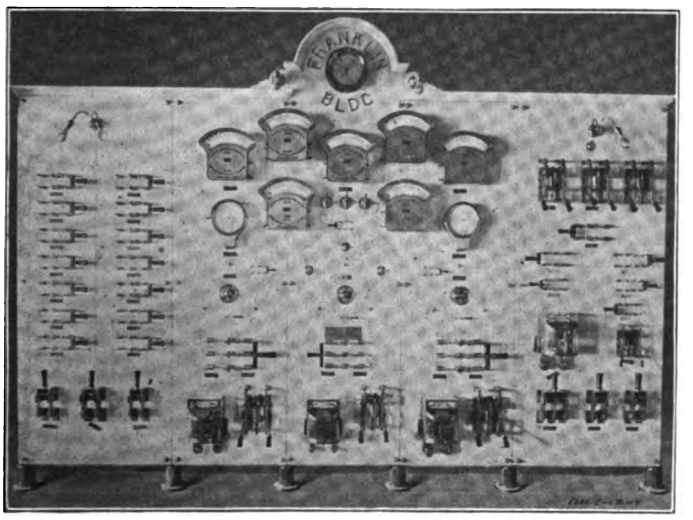
This switchboard is 9 feet high and 17 feet long, divided into five panels of white Italian marble, capped off with marble moulding, and the letters "Franklin Building" made in bronze letters raised somewhat from the surface of the board. The board is illuminated by two two-light copper brackets and five one-light brackets, and has mounted on it a Weston illuminated type voltmeter and an ampere meter for the various generators, also a recording Bristol ammeter and voltmeter. One of the most important improvements on this board is the use of the now well-known "Ideal" circuit breakers. These circuit breakers are handsomely finished and of the independent type, making it impossible to close the circuit so long as the overload exists.

The motion of these circuit breakers is vertical. Instead of being opened outward from the board, like other circuit breakers in general use, they run in a vertical direction. They are all made of pure hard-drawn copper, nicely fitted and handsomely finished. The bearing parts, such as the guide bearing and base, are made of tool steel polished and copper plated, so as to match the other copper work on the circuit breakers.

Every generator is protected by one "Ideal" circuit breaker. Each elevator is also protected by one "Ideal" circuit breaker, as well as the independent motor circuit which controls the exhaust stand.

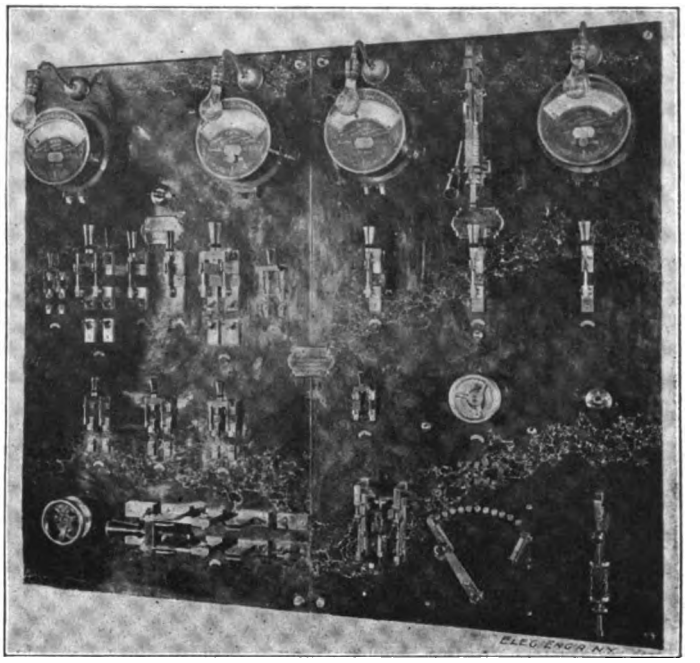
All the switches are of the F. A. La Roche & Co.'s make, of the double-throw quick-break type, built of all pure hard drawn copper, beautifully finished, and they are used in combination with the General Electric wattmeters, seen at the lower end of the board. Each switch is protected with a safety fuse, which is on an independent slab of slate on the top of the board, so arranged that new fuses can be put in instantly.

This board is a handsome, substantial and mechanical piece of work. All bus-bars are of the rectangular type. These copper



SWITCHBOARD IN THE FRANKLIN BUILDING, NEW YORK.

bars are used, all being jointed at right angles, securely braced and bolted together, and the result is a very massive looking piece of work. The board is designed so as to secure the greatest flexibility in handling and operating. All the switches are of the double-throw type, with the object of giving the operator an opportunity of using either or all of the dynamos on either or both of the elevator services, or from a light service, or of throwing any one or all of the individual circuits of the house service should any part of the plant become suddenly heavily overload-



SWITCHBOARD MANUFACTURED BY F. A. LA ROCHE & CO.

ed, the building itself being designed for a power and loft building.

Fig. 2 represents a switchboard, also manufactured and installed by F. A. La Roche & Co., under the supervision of the electrical engineers, Messrs. Osterberg & Sutton, and is a unique and handsome piece of work. The board is made up of two pieces of extra marbleization and mounted on a heavy, substantial iron frame. One panel controls the storage battery plant and one the generating plant.

On this board are used the round type Weston instruments and the "Ideal" circuit breakers of the vertical type, similar to those used on the board above described, excepting that they are single pole instead of double pole. The switches and other apparatus on this board are also made by F. A. La Roche & Co. It is claimed that this is the neatest and most condensed board of its size in New York City.

F. A. La Roche & Co. are getting more than their share of this class of work and enjoy the reputation of doing some of the finest switchboard work in New York City. They have just completed the R. G. Dun Building switchboard, which has many novelties and interesting features. Among the many other boards manufactured and installed by them are those in the Standard Oil Building, Bowling Green Building, Hearn & Sons new building (two boards), Franke apartment house, Dexter Lambert Company, Oberg & Blumberg, Star Theatre, Metropolis Theatre, Manhattan Theatre, Crescent Theatre, Tulane Theatre, Cooke Locomotive Works, Wilson Aluminum Company, and many others.

The American Indies Company.

Articles of incorporation of the American Indies Company, with $18,000,000 capital, have been filed with the Secretary of the State of New Jersey at Trenton. The incorporators of the company are Thomas Dolan, P. A. B. Widener and W. L. Elkins, of Philadelphia; Thomas F. Ryan, Frederick P. Olcott, A. N. Brady, R. A. C. Smith, Henry D. Macdona, J. N. Ceballos, Guillermo de Zaldo, H. P. Booth and H. G. Runkle.

It is understood that the insiders will contribute all the necessary capital and that there will be no public subscription.

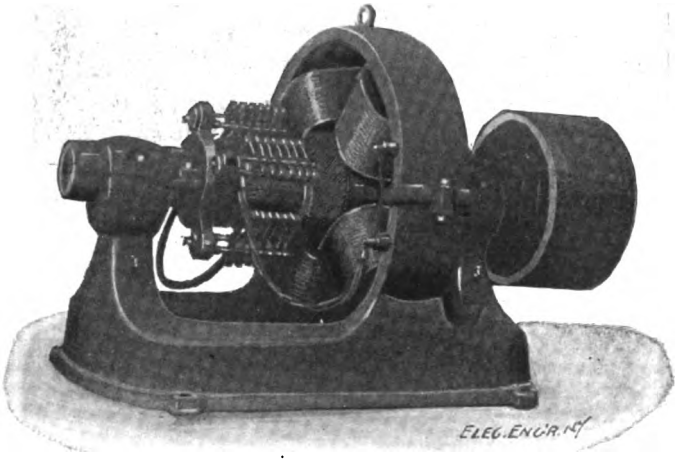
Under its charter the American Indies Company has the power to generate, accumulate, distribute and supply electricity for light, heat, power and signalling purposes, to construct, own and operate lights for the conveyance of electrical current for

Digitized by Google

telegraph, telephone and other purposes, to construct, own and operate telephone exchanges, to manufacture and supply gas for fuel and illuminating purposes, to light cities, buildings and places, both public and private, by gas and electricity and to acquire property and undertake engineering works generally, especially such operating under public franchises. The secretary of the company is Mr. Henry D. Macdona, of 33 Nassau street, New York.

The Goughnour Dynamos and Motors.

DYNAMOS, stationary motors, starting boxes and regulators for all purposes and of almost any capacity constitute the output from the works of the Goughnour Electric Company, Canton, O., and while the establishment is comparatively a small one, it is not too small to grow. This it is doing at a rapid rate, so that already an enlargement of space and equipment is contemplated, although the business is not more than five years old. Some of the special features embodied by Mr. Goughnour in his machines are the ironclad armatures, steel fields, low armature resistance, strong magnetic fields, extra large commutator and high electric efficiency all around. Among the special designed motors are machines for operating iron working tools, cranes, hoists and elevators, while the dynamos include machines for lighting, direct coupled or belted, power



GOUGHNOUR DYNAMO.

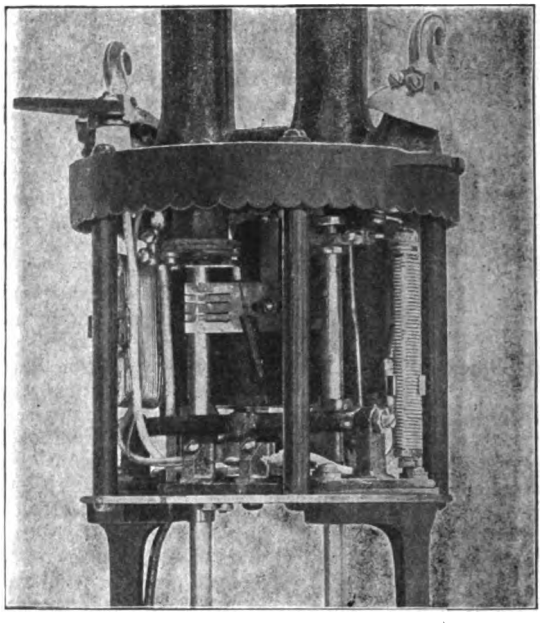
generators and machines for plating. The works are located at the corner of Seventh street and Valley Railroad, and the tool equipment consists of an outfit sufficient for doing the entire work, including a number of homemade labor-saving appliances. Power for operating the tools is derived from a motor of Mr. Goughnour's own make, operated by current supplied from the city lighting plant. Lighting generators have been constructed for several isolated plants in Canton; also a plating dynamo of 1,200 ampere capacity for a safe manufacturing company, and a crane motor outfit for a cement manufacturing plant in a neighboring town. The works enjoy not only a local patronage, but orders are constantly coming in from neighboring States, due to the good report that has gone out from the local plants, where the Goughnour machines have been in use.

E.M.F. of the Arc With Aluminium Electrodes.

It is known that an electrolytic cell having carbon and aluminum electrodes opposes the passage of current in the aluminum-carbon direction with an e. m. f. of 22 volts, while current passes in the other direction with only the opposition due to the resistance of the liquid and the polarisation e. m. f. Herr V. von Lanz describes in Wiedmann's Annalen his researches upon the arc with aluminum electrodes. This arc is established under an e. m. f. of 19 volts. Between electrodes of aluminum and carbon the current passes more easily from aluminum to carbon, an effect contrary to that noticed in the electrolytic cell. This arc may be used therefore for the rectification of alternating currents, but the efficiency of such a rectification would not be higher than about 6 per cent.

G. E. Brush Single and Double Carbon Arc Lamps.

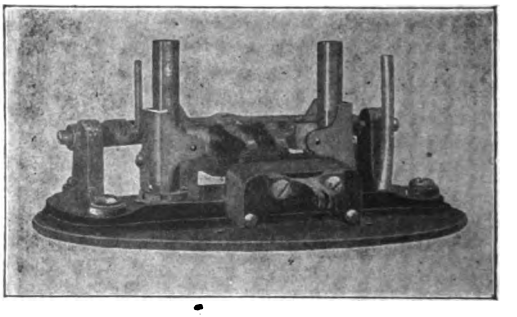
IN the differential Brush arc lamp, now put out by the General Electric Company, every improvement has been incorporated which long experience has shown to be advisable. It is especially valuable where a large number of lamps are run from one generator. The differential winding consists of a coil of



G. E. BRUSH DOUBLE CARBON ARC LAMP MECHANISM.

coarse wire in series with the arc and a fine wire coil connected around the arc. Current in the coarse wire tends to separate the carbons, while in the fine wires it operates to bring them together and, the opposite forces exerted by the shunt and series windings being automatically balanced when the carbons are burning normally, if the series current is reduced the voltage at the lamp correspondingly diminishes. With differential lamps generators can, therefore, be heavily overloaded. The improved Brush lamp is adjusted at the factory and, as the mechanism is not dependent upon springs for any of its movements, this adjustment cannot change. Hence the lamp runs as economically after several years of service as when first installed. It regulates so closely that the voltmeter on a circuit of lamps shows no appreciable variation.

These lamps do not require hoods when hung outside, as all parts are thoroughly protected from the weather. The chimney and its base are cast in one piece and, wherever a screw enters



SUPPORT FOR ARMATURE LEVER.

the lamp from above, its head rests on a boss which prevents the entrance of rain or melted snow. The outside terminals of the lamp are made with petticoats as a further protection against the entrance of water.

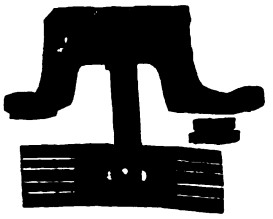
All parts are made by special machinery and are interchangeable. There are no springs to adjust or replace. The various contact surfaces are ample and the insulation is so distributed that the danger of short circuits is eliminated. The use of one large insulating strip diminishes the number of insulation pieces

Digitized by Google

required to secure the lower frame in position. All brass parts, except the carbon rods, are finished in nickel plate, adding to their durability as well as to the appearance of the lamp.

The mechanism frame has been so modified that the armature lever is now supported by a base separate from the frame and mounted on a plate which insulates it entirely from the frame and zinc bottom of the lamp box. The armature lever has been slightly changed on account of changes in other parts and also to so support the balance wire in the double lamps that the second carbon feeds at practically the same voltage as the first carbon. This improvement makes a marked saving during the entire second half of the night's run often amounting to from 30 to 50 watts.

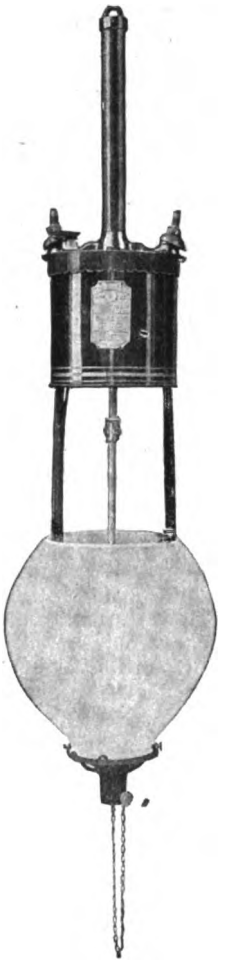
Realizing the advantage of using a lamp on circuits of either



DOUBLE CARBON BRUSH AND INSIDE TERMINAL.

CLUTCH WITH ROD RELEASED.

THE CUT-OUT.



SINGLE CARBON BRUSH LAMP.

6.6 or 9.6 amperes, the magnets of this new lamp have been so designed that when changing from one circuit to the other it is only necessary to exchange the adjusting coil for one suitable to the new rating. The adjuster formerly sent out may be used for 1,200 candle power (6.6 amperes), but should be changed to one of coarser wire when used for 2,000 candle power (9.6 amperes). The new magnets are interchangeable in pairs with those of the old style lamp, but new magnets for old 2,000 candle power lamps must be always used with the new adjuster for 2,000 candle power.

The new adjusting coil is furnished with a screw clip, which compensates for about one ampere, either more or less. When changing or renewing this coil it is only necessary to loosen two screws. The magnets may be removed by simply taking out four screws and unhooking the small brass connecting springs. The connection springs furnish a most convenient method of connecting the magnets into circuit and are of such sizes that the current they carry cannot heat them enough to change their tension.

Successful operation requires at all times a perfect contact between the rod and the inside terminal. In this lamp it is necessarily a sliding contact, and the brush used keeps the surface bright and clean. The new brush is one inch wide, punched out of phosphor bronze and so slotted as to present five narrow fingers crosswise to the rod. The same punching is used on both single and double lamps, the double lamp requiring two strips and the single lamp one strip, bent double. When worn out the contact brush may be quickly replaced without disturbing any other parts of the lamp. The improved contact is interchangeable with the old if the new contact support bracket is also used.

No part of an arc lamp is more affected by wear than the carbon rod. Each day the exposed portion of the rod is rubbed and, in time, its diameter so reduced that the clutch opens more quickly than when the rod is full size. The new form of clutch makes the feeding of the lamp independent of changes in the diameter of the rod. The wear caused by scouring is on the lower half—the part that rests in the bushings when new carbons are in the holders and the best alignment is necessary. To overcome trouble due to excessive wear a reversible rod is introduced which may be quickly removed, turned end for end and put back into the lamp, while the lamp is hanging in position. The reversible rod lasts twice as long as the old rod. It also prolongs the life of the contact brushes, the guide bushings and the clutches, a rough or pitted arc causing arcing and increased friction.

The rod caps are held in place while the rod is unscrewed, and are long enough to remain in position on the upper bushing when the rod has been removed.

The two things necessary in a satisfactory carbon rod clutch—absolute uniformity of grip irrespective of the condition of the rod, and a means of accurate adjustment for wear of the rod or clutch, are found in the improved clutch. The surfaces bearing on the rod are so long (1¼ inch) that the grip is not affected by roughness, dirt, or even dents in the rod. To adjust the clutch the position of the trip is changed by loosening one screw only.

The shoe is of peculiar construction, being pivoted above its centre to a lever which itself is so pivoted to the clutch body as to give a motion to the shoe perpendicular to the rod when the lever moves vertically. In action this clutch is positive—releasing the rod at a given point and instantly gripping it again when the lever is raised. The rod is always either firmly clutched or entirely free to fall. The simple construction of the clutch is obvious from the illustration. It comprises but four parts beside the screw and rivets, and the same clutch is used on both single and double lamps. The bushings for guiding the carbon rods must be replaced occasionally, a worn out bushing being often a source of trouble. The main inside terminal of the lamps have been so modified that but a few minutes work is required to replace a worn bushing. The carbon rod is removed from its cap, the worn bushing unscrewed, the new one inserted and the rod replaced. The new bushings cannot be used in the old lamps without a new inside terminal, which may be substituted for the old terminal and admit also the use of the new upper bushings.

The carbon holders have a V grip on the carbon. The upper holder is made in two sizes, taking seven-sixteenths-inch or one-half-inch carbons and nine-sixteenths-inch or five-eighths-inch carbons respectively. It may be supplied with a flange to prevent injury to the rod in case of a flaming carbon. The lower carbon holder takes any size of carbon from seven-sixteenths-inch to five-eighths-inch inclusive. Its position is adjustable. To enable them to resist corrosion the holders are nickel plated.

The starting resistance is wound on a separate frame, which may be quickly removed, as only one screw with a metal clamp secures it to the side frame of the lamp mechanism. The cut-out is operated by the mechanical movement of the armature. When the current is too weak to energize the magnets the armature falls by force of gravity, throwing the cut-out into circuit. Its contact surfaces are broad and, as they are vertical, dust cannot collect on them to prevent good connection.

In cases of accident to the main circuit of the lamp such as breaking the carbons, the whole current of the lamp would tend to flow through the fine wire of the magnets before the armature would have time to drop and throw in the cutout. To prevent any possible damage during this brief interval, an auxiliary cut-out is inserted which at such a time opens a path for the total current around the magnets until the main cut-out can operate, when the auxiliary cut-out is itself thrown out of the circuit. On the double lamp the globe holder is secured by a thumbscrew, the loosening of which permits the globe to be lowered until stopped by the nut on the centre support rod. The globe holder on the single lamp is also secured by a thumbscrew, and when

Digitized by Google

lowered is supported by a chain attached to the lower frame of the lamp. If desired, the double lamp is supplied with drop tubes for the lower carbons. The globe holder of the single lamp for indoor use is fitted with a dust pan to prevent sparks and dust dropping through the globe holder.

When lamps are to be used indoors or in protected positions sheet-iron casings are furnished, but if they are to be exposed to the weather, especially near salt water or in a location where corrosion of the iron is likely to take place, the use of a copper casing is recommended. By simply pressing a spring clip on the upper side with one hand the casing may be removed. All casings are finished in black enamel. No solder is used in assembling the lamp, and no tool but a screw driver is required to take it apart.

SOCIETY & CLUB NOTES

Eighth Annual Meeting of the American Electro-Therapeutic Association, Buffalo, N. Y., September 13, 14 and 15, 1898.

SHORTLY after 10 a. m. Dr. Charles Rea Dickson, of Toronto, Canada, president of the American Electro-Therapeutic Association, called together the eighth annual meeting of the association in the rooms of the Buffalo Society of Natural Sciences.

President Dickson introduced Dr. Conrad Diehl, Mayor of Buffalo, who extended to the members of the association the freedom of the city. He spoke of the growth and development of electrical treatment since the time it was first adopted by the medical profession, as an important part of the professional apparatus. Dr. Diehl said that the street cars of Buffalo were now run by electric power from Niagara Falls, and urged the members of the association to inspect the electrical plant of the Buffalo Railway Company.

Dr. Francis B. Bishop, of Washington, responded to the Mayor's welcome on behalf of the American Electro-Therapeutic Association.

Reports of standing committees on scientific questions were next in order. Dr. Margaret A. Cleaves, of New York, presented her report on meters. The report was accepted and the committee requested to continue its labors. Dr. Cleaves announced that the committee was not willing to continue its work, but desired the appointment of a new committee on meters.

On constant current generators and controllers the report was asked for from the chairman of the committee, Dr. William J. Herdman, of Ann Arbor, Mich., but in his absence an auxiliary report was presented by another member of the committee, Dr. Robert Newman, of New York, who in 1896 was president of the American Electro-Therapeutic Association.

John J. Carty, electrical engineer, of New York, made a brief report of progress. He is chairman of the committee on electric light apparatus for diagnosis and therapy and the Roentgen X-ray.

Dr. Margaret A. Cleaves, of New York, read a paper on "Phlebitis, a Clinical Study," in which she gave a number of instances which had come under her professional supervision.

Dr. A. D. Rockwell read his paper on "The Diagnostic and Therapeutic Relations of Electricity to Diseases of the Central Nervous System."

AFTERNOON SESSION.

Shortly after 2 p. m. the second session of the American Electro-Therapeutic Association was called to order by President Dickson. The first paper on the programme was by an honorary fellow of the society, Dr. Georges Apostoli, of Paris. The subject was "New Uses of the Undulatory Current in Gynaecology." The paper was translated from French into English and was read by Dr. G. Betton Massey, of Philadelphia.

"Electricity in the Treatment of Uterine Fibromata" was the subject of a paper by Dr. Felice La Torre, of Rome, Italy, read by Dr. John Gerin, of Auburn, secretary of the association. Then came a paper on "Electro-Therapeutics in Gynaecology," by Drs. Georges Gautier and J. Larat, of Paris, France, read in English by Dr. Dickson, president of the association, followed by "The Treatment of Uterine Fibroids by Small Currents, Administered Percutaneously," by Dr. Richard J. Nunn, of Savannah, Ga.

Dr. W. H. White, of Boston, read a paper by Dr. Adelstan de Martigny, of Montreal, on "Treatment of Menorrhagia by Weak Current and Silver Internal Electrode."

This was the concluding paper on the afternoon programme. An early adjournment was taken in order that members of the association might avail themselves of the tally-ho ride about the city, planned by the committee on arrangements.

An invitation to the association to visit the storage battery of the Buffalo Railway Company was sent by Superintendent Danforth at the request of Mayor Diehl.

RECEPTION FOR THE VISITORS.

At 8:30 p. m. a public reception in honor of the members of the American Electro-Therapeutic Association was held in Alumni Hall, University of Buffalo Building, which was largely attended, many medical men of Buffalo being present.

Dr. Henry R. Hopkins, of Buffalo, a member of the local committee on arrangements, spoke of the earnest work of the medical men in this country. Dr. Charles Rea Dickson, of Toronto, president of the American Electro-Therapeutic Association, made a few remarks, in which he spoke of the fraternal feeling existing between the two great English-speaking nations at the present time.

Dr. Robert Newman, of New York, made a brief address, as did Dr. G. Sterling Ryerson, of Toronto, Deputy Surgeon General of the Canadian Militia.

SECOND DAY'S SESSION.

An executive session of the American Electro-Therapeutic Association was held at 9 a. m.

The report of the executive council on the revision of the constitution and by-laws was adopted, making some important changes in the governing rules of the association.

The first paper was presented by Dr. Lucien Howe, of Buffalo, who represented the Erie County Medical Society and also the New York State Medical Society at the convention. Dr. Howe's subject was "The Method for Using Cataphoresis in Certain Forms of Conjunctival Inflammation."

Dr. Howe illustrated his address by means of a number of his patients. His lecture was received with great interest and considerable discussion followed. Many questions were asked Dr. Howe concerning his methods of treatment.

Dr. Robert Newman, of New York, presented an able paper on "Electricity in Deafness and Stricture of the Eustachian Tube." In his address Dr. Newman rehearsed the history of a peculiar case which came under his professional care. He also cited a number of other cases, which had been reported by other physicians.

The discussion which followed Dr. Newman's paper was led by Dr. Howe, followed by Dr. A. D. Rockwell, of New York.

Dr. Grover W. Wende, of Buffalo, read a paper on "Electricity in Acne Vulgaris and Acne Rosaceae."

Dr. G. Betton Massey, of Philadelphia, led the discussion of Dr. Wende's paper, followed by Dr. Margaret A. Cleaves, of New York.

Dr. G. Sterling Ryerson, of Toronto, Deputy Surgeon General of the Canadian Militia and the accredited delegate of the Ontario Medical Association, was introduced by President Dickson, and spoke briefly, giving a number of instances of the effect of lightning-stroke causing diseases of the eye, in which the results were not permanently serious.

Dr. Francis B. Bishop, of Washington, presented a paper on "High Tension Current in Neuritis," which was followed by considerable discussion.

The final paper of the morning session was by Dr. Charles Rea Dickson on "Electricity in the Treatment of Goitre."

At 1 o'clock the convention adjourned until 2 p .m.

AFTERNOON SESSION.

President Dickson delivered his annual address, a part of which is as follows:

"The necessity for the existence of such an association as ours has been questioned not only here, but elsewhere, hence it may be necessary to explain our position. It has been asked 'Why should there be such an association?' Electricity is only one of many therapeutic agents, and it would be absurd to have a separate association to consider each therapeutic agent. At first

Digitized by Google

glance this may seem a quite rational question. Our colleges teach us how to administer opium and its various derivatives, therefore the necessity for an opium society does not exist, but do our colleges teach us anything about electricity worthy of the subject? The answer to this question is quite unnecessary in the presence of the members of our association. Anyone should be depended upon to prescribe and administer the ordinary, or even extraordinary, remedies to carry out any regulation form of treatment. But I, for one, should fear to trust myself to the tender mercies of the general practitioner of to-day did he, in his wisdom, consider it necessary to use this agent, electricity, unless he had paid some special attention to the mastery of it. The contention is an absurdity unworthy of America, the vaunted land of progress, and of Buffalo, the Electrical City. In my own benighted land, even, we are more enlightened than that. This is an age of specialism.

"The old-time practitioner, then the physician and surgeon, seems passing away. Surgery is being divided and subdivided, until at one time we feared that we were to be confronted with an appendix surgeon. Our patients are reaping the benefit of all this. Why, then, should we call a halt? No! Let onward be our cry. The time is past when a physician, the proud possessor of a solitary magneto-electrical machine, turned by a crank, considered his armamentarium electricum quite complete. One has but to glance at our programme to see to what extent electricity may be used to advantage. A programme such as ours should prove a perfect revelation to him who has not kept well up to this progressive age. Could such a programme or one-hundredth part of it be intelligently discussed in any other existing society to-day not dealing distinctly with the subject? No, I greatly fear it would be a hidden book, a stumbling block.

"The hope of the future lies in those who are now thronging wisdom's halls, and it is a subject for congratulation that this association is to be asked to take action, bringing the needs of the hour before the authorities competent to deal with them. The student with mind as yet unwarped by prejudice must be in a position to obtain a comprehensive, intelligent grasp of the whole subject, that he may turn his theories to practical account in his professional career. But even he, unless endowed by these inestimable blessings, common sense, patience and gentleness, will find his efforts unavailing, and he must be a close observer of Nature and her laws, seeking to assist rather than to combat her. Electricity is an agent most powerful for weal or woe. A great responsibility rests upon our educators, and the sooner they awake from their strange lethargy the better will it be for our reputation as an enlightened, progressive, scientific profession. The commercial world has taken such advantage of the rapid strides of electricity as a science with fixed laws that we have laid ourselves open to the charge of neglect. Let us hasten to make amends for the past and remove some of the reproaches that rest on this, the noblest profession in this fair world.

"Our association was organized some eight years ago, because it was felt that the subject of electro-therapeutics could not be discussed in any existing society in a scientific and practical manner without controversial digressions of no value whatever. It was felt, and felt strongly, that electricity had been left too long to the charlatan, the incompetent and the unscrupulous. It was also felt that we had another foe of hardly less dangerous character, the over-zealous.

"To combat all these and cultivate and promote knowledge of electricity wherever it can be of service in medicine and surgery is the object of our association. It must be admitted that we are setting about this in the most practical manner possible. In fact, I know of no other association in which more practical or more useful work is being done. To carry out this idea successfully we have associated with us other than purely medical practitioners, and the association has proved a most happy one, and fruitful of nothing but good. Thus the electrical engineer and expert study electricity's laws and note its action upon inert matter. The biologist and physicist go a step farther and study these laws in their action upon living tissue, and their labors are turned to practical account by the physician and surgeon. The curative and palliative powers of the agent are available to all who have access to my clinics.

"The clouds are breaking on our horizon. On my side of that imaginary boundary line we find increasing interest being manifest, and it gives me the greatest satisfaction to say that my own warmest friends in the city of my adoption are the men who stand in the front ranks of medicine and surgery, and electro-therapy has a recognized standing, inasmuch as special departments devoted to it are to be found in our public hospitals. I have had the honor to organize and now to preside over four such departments in as many hospitals, and more intelligent inquiries are being made by the students of the various medical colleges, all of whom have access to my clinics.

"A rock we must avoid is that on which many a stronger society than our own has come to grief, the clique. And the furtherance of personal ambition or personal designs must be shunned."

All the suggestions embodied in the address were referred to the executive council of the association.

The programme for the afternoon was made up of a series of ten-minute talks on "Electro-Therapy," and the subject was one to attract a widespread interest among members of the medical fraternity.

Dr. G. Betton Massey, of Philadelphia, presented a paper on "The Galvanic Current in Gynaecology." The next paper was "Surgical Uses of Electricity," by Dr. Charles Rea Dickson, president of the association.

Dr. Robert Newman, of New York, presented a paper on "Electricity in Genito-Urinary Diseases." Dr. G. Betton Massey spoke on "Treatment of Malignant Growths by Means of Electricity."

A paper by Dr. Louis A. Weigel, of Rochester, on "Orthopædic Uses of Electricity," was followed by a paper by Dr. Rockwell on "Functional Diseases of the Nervous System Treated by Electricity."

The association adjourned at 4:30 p. m. and proceeded by special car to visit the power house and storage batteries of the Buffalo Railway Company.

A short business session of the American Electro-Therapeutic Association was held from 8 to 9 p. m., at which the following officers were elected: President, Dr. Francis B. Bishop, of Washington; first vice-president, Dr. Ernest Wende, of Buffalo; second vice-president, Dr. W. H. White, of Boston; secretary, Dr. John Gerin, of Auburn; treasurer, Dr. Richard T. Nunn, of Savannah, Ga.; executive council, Dr. Robert Newman, of New York, and Dr. G. Betton Massey, of Philadelphia, three years; Dr. A. D. Rockwell and Dr. William J. Morton, of New York, two years; Dr. Charles R. Dickson, of Toronto, and Dr. Frederick Schavoir, of Stamford, Conn., one year. Washington was selected for the convention next year, to be held September 19-21, 1899.

Dr. Lucien Howe entertained the men of the association at the conclusion of the business meeting. A smoker was given at Dr. Howe's home, corner of Delaware avenue and Huron street, which was largely attended.

THIRD DAY'S SESSIONS.

A vote of thanks was tendered to Dr. Wende, chairman of the local committee on arrangements; to the Buffalo Commercial for its kindness, not only during the convention, but in publishing the preliminary news of the association; to Dr. Howe, for his entertainment last evening; to Mayor Diehl, to the Buffalo Railway Company, Buffalo Historical Society, Fine Arts Academy, president and secretary of the association, and Dr. Newman, of New York, and to the press generally.

The congratulations of the American Electro-Therapeutic Association were extended to the University of Buffalo for its progress in establishing a chair of electro-therapeutics in the medical college.

A general vote of thanks was also adopted, expressing the association's deep appreciation of the courtesy and hospitality extended to the members during the convention in Buffalo.

At 10 o'clock the executive session adjourned and President Dickson called the scientific session to order. The first two papers on the programme were read by title. They were both by Drs. Georges Gautier and J. Larat, of Paris, France, the first on "The Hydro-Electric Bath with Sinusoidal Current in Disease," the second on "The Use of Hot Air and Light Bath in Disease."

A paper was read by the newly-elected president of the association, Dr. Francis B. Bishop, of Washington, on "Alternating Dynamo Currents."

Dr. Margaret A. Cleaves, of New York, read a paper on "The Electric Arc Bath."

A paper by Dr. J. H. Kellogg, of Battle Creek, Mich., on "The Electric Light Bath" was read by title. The next paper was by John J. Carty, of New York, on "Some Suggestions on

Digitized by Google

the Possibilities of Cataphoresis." Mr. Carty gave a short, practical talk, which was very interesting.

A paper by Dr. G. Herbert Burnham, of Toronto, Canada, on "Electricity in the Treatment of Certain Diseases of the Eye," was read by title.

Then came a paper by Nikola Tesla, read by Dr. White, of Boston. The subject was "A High Frequency Oscillator for Electro-Therapeutic Purposes."

The following papers were read by title: "The Effect of High Tension Discharges Upon Micro-Organisms," Drs. J. Inglis Parsons and C. Slater, London, England; "The Action of X-Rays Upon Tuberculosis," Dr. J. Bergonie, Bordeaux, France; "Two Years of Practice in Radiotherapy," Drs. Georges Gautier and J. Larat, Paris, France.

Dr. Newman, of New York, and Dr. Nunn, of Savannah, Ga., were appointed a committee by the president to conduct the president-elect, Dr. Bishop, of Washington, to the chair. Before turning over to his successor the gavel and other insignia of office Dr. Dickson took occasion to thank the association for its kindness and courtesy to him during his term of office.

The afternoon was devoted to an excursion and reception under the direction of the local committee of arrangements.

On Friday afternoon the members were conducted over the power house of the Niagara Falls Power Company by Coleman Sellers, E. D., president and chief engineer, who made the visit a most interesting and instructive one. On returning to the hotel a meeting was held and Dr. C. R. Dickson was requested to convey to Dr. Sellers the thanks of the association for his courtesy.

Those who remained visited on Saturday morning Power Station No. 2 of the Niagara Falls Hydraulic Power and Manufacturing Company, being conducted over it by the chief electrician, who fully explained all the appliances.

A most interesting exhibition of electrical apparatus for diagnostic, therapeutic and radiographic purposes was held in the room adjoining the meeting hall. The following manufacturers exhibited: Van Houten & Ten Broeck, New York; Chloride of Silver Dry Cell Battery Company, Baltimore, Md.; Jerome Kidder Manufacturing Company, New York; Edison Manufacturing Company, New York; Waite & Bartlett Company, New York; Dow Electric Assistant Company, Boston, Mass.; the American Electro-Neurotone Company, Niagara Falls, N. Y.; the Standard Cold Electric Lamp Company, Washington, D. C.; the Spencer Lens Company, Buffalo, N. Y.; the Detwiller, Biddle Company, Buffalo, N. Y.; W. J. Shields & Co., New Wilmington, Pa.; Rochester Fluorometer Company, Rochester, N. Y.

The eighth annual meeting was unanimously conceded the most successful and enjoyable that has been held, and the prospects for the association were never brighter or more encouraging.

American Institute of Electrical Engineers.

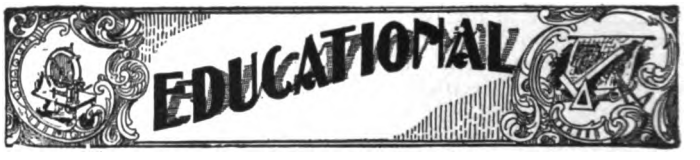
THE one-hundred and twenty-seventh meeting of the Institute, and the first of the present season, was held at 12 West Thirty-first street, New York City, Sept. 28, 1898. President Kennelly in the chair. A paper was presented by Messrs. Charles P. Matthews, W. H. Thompson and J. E. Hilbish on "The Photometry of the Enclosed Alternating Arc." In the absence of the authors the paper was read by the secretary. The discussion was opened by Mr. Louis B. Marks and continued by Mr. W. H. Freedman, Capt. John Millis and Dr. Kennelly. At the meeting of Council in the afternoon the following associate members were elected: Frederick William Carter, Lecturer in Electrical Technology, City and Guilds of London Institute, Exhibition Road, London, S. W. Walter H. Coleman, superintendent and treasurer, Andover Electric Co., Andover, Mass. Henry L. Doherty, general manager and engineer, Madison Gas & Electric Co., Madison, Wis. Geo. W. Frank, Jr., secretary, treasurer, and general manager, The Kearney Electric Co., Kearney, Neb. R. H. Mansfield, Jr., electrical engineer and general manager, Ward Leonard Electric Co., Bronxville, N. Y. Kempster B. Miller, chief electrician, Western Telephone Construction Co., 33 Elaine place, Chicago, Ill. Gilbert Rosenbusch, engineer, Sprague Electric Co., South Orange, N. J. John West Thompson, superintendent Cia de Luzy Fuerza Motriz Electrica, Guadalajara, Mexico. Henri Tripier, counsel and technical engineer of the Compagnie des Transports Electriques de l'Exposition, Paris, France; residence, 16 rue Ganneron, Paris, France. Herbert A. Wagner, general superintendent, Missouri, Edison Electric Co., and also with Wagner Electric Mfg. Co., 415 Locust street, St. Louis, Mo. William Henry Williams, Professor of Mechanical and Electrical Engineering, Montana State College, Bozeman, Mont.

Municipal Electricians' Association.

CHAIRMAN ELLETT, of the Executive Committee, Association of Fire and Police Telegraph Superintendents and Municipal Electricians, has issued a call for a meeting of his committee for Oct. 8 and 9, at Wilmington, Del., the home of the president of the association, Mr. John W. Aydon. The following gentlemen compose the committee: W. Y. Ellett, superintendent fire telegraph, Elmira, N. Y., chairman; N. W. Mead, city electrician, Pittsburg, Pa.; Capt. Wm. Brophy, chief electrician Wire Inspection Department, Boston, Mass.; W. H. Thompson, city electrician, Richmond, Va.; F. C. Mason, superintendent police telegraph, Brooklyn, N. Y. The committee at this meeting will revise the by-laws of the association and decide upon matters pertaining to the next regular meeting of the association, which will be held at Wilmington, Del., Sept. 5, 1899. All members of the association are invited to be present at this meeting of the Executive Committee on Oct. 8 and 9. President Aydon has arranged to entertain all who can make it convenient to be present. Applications for membership will also be received and acted upon at this session.

Opening of the Twentieth Triennial Exhibition of the Massachusetts Charitable Mechanic Association.

For many months active preparations have been going on for the Mechanics' Fair to be held in Boston during the coming winter. The private and official opening will occur on Saturday evening, Oct. 8, on which occasion the Governor of Massachusetts will formally open the exhibition, completing the electric circuit, which will set the machinery in motion. The exhibition, which promises to be a grand success, will be available to the public on Oct. 10, the admission to everything being 25 cents. This includes wireless telegraphy and X-ray exhibits, the Diesel motor and the historic wax tableaux, a theatre managed by Keith, the concert and Japanese tea garden, oriental smoking room and the patriotic, scientific and educational departments.



Electrical Instruction by Mail in New Jersey.

A meeting of exchange managers, switchboard men, linemen and other employees of the New York & New Jersey Telephone Company, from Newark, Jersey City, Paterson, Hoboken, Orange, Asbury Park, Morristown and other places in Northern New Jersey was held on the evening of the 23d inst. at the office of the New York & New Jersey Company, No. 185 Market street, Newark, N. J., when The Electrical Engineer Institute of Correspondence Instruction, No. 120 Liberty street, N. Y., was represented.

Mr. Alfred J. Wolf, of Brooklyn, N. Y., delivered an address, describing the plans, purposes and methods of the Electrical Engineer Institute, for conveying instruction by correspondence in the various branches of electrical engineering, and was followed by Mr. Henry W. Livingston, chief representative of the Institute, who called additional attention to the educational facilities afforded and to the convenient terms of payment for courses of instruction which the Institute allows. Mr. Edward E. Winters, formerly superintendent of the New York Light, Heat and Power Company, was also present at the meeting on behalf of the Institute and aided Messrs. Wolf and Livingston at the close of the meeting in entering a large number of enrollments of students, chiefly for the special course in telephony.

The Institute has been so much appreciated by the officers of the company mentioned that a series of technical lectures by eminent electricians is in contemplation, to be given during the coming winter in Brooklyn, Jersey City and Newark, to harmonize

Digitized by Google

with and make additionally beneficial the Institute's lessons. The enrollment of employees in the courses of the Electrical Engineer Institute, aided by these lectures, is intended to take the place of a very complete night school system, which was, until somewhat recently, in contemplation by the officers of the company, but which has now been abandoned in favor of the preferable and more practicable plan of correspondence instruction, properly administered.

Educational Work of the Young Men's Christian Association.

We have just received from the Educational Department of the International Committee of the Y. M. C. A., with headquarters at 3 West Twenty-ninth street, New York, copies of their prospectus and the annual report of educational work in the associations of North America for 1898. In brief they deal with the various educational features of the associations, and give special attention to the work of the evening schools operated under the auspices of the associations in 350 cities, in which 1,250 teachers give instruction to 26,000 young men. These students are on an average 23 years old, are employed in the daytitme, and in the majority of places, but for these facilities, would be denied the educational opportunities they desire. This work, supplementing that of the public schools, is rapidly increasing in efficiency and popularity. Through the system of standard courses maintained by international examinations, as described in the prospectus, students can prepare for college without further examination. Sixty leading colleges and universities accept these international certificates. Last year 750 certificates were won. Mr. Frederic B. Pratt is chairman and Geo. B. Hodge secretary of the Educational Department, to whom all correspondence should be addressed.

Classified Digest of U. S. Electrical Patents Issued September 27, 1898.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. T. H. Pettingill, Amsterdam, N. Y., 611,460. Filed Sept. 4, 1897. A "ring-clutch" feed for those double carbon lamps commonly known as the "Thomson-Houston."

Measurements:—

ALTERNATING CURRENT MEASURING INSTRUMENT. H. P. Davis, Pittsburg, Pa., and F. Conrad, Wilkinsburg, Pa., 611,466. Filed May 7, 1898. Comprises a laminated core having an air gap, a primary actuating coil, a secondary coil, a disc armature having radii of different length, an indicating pointer and a spring tending to hold the armature and pointer at the zero position.

ALTERNATING CURRENT VOLTMETER. H. P. Davis, Pittsburg, Pa., and F. Conrad, Wilkinsburg, Pa., 611,592. Filed June 18, 1898. Combines a closed-circuit armature and means for indicating the extent of its movement against an opposing force, primary and secondary actuating-coils and a demagnetizing secondary coil having a high temperature coefficient and compensating for changes in temperature.

Miscellaneous:—

ELEVATOR SAFETY ATTACHMENT. W. C. Preston, Providence, R. I., 611,332. Filed April 22, 1897. Details of construction.

Railways and Appliances:—

TRUSS FRAME FOR ELECTRIC VEHICLES. K. Knudsen, Chicago, Ill., 611,258. Filed Oct. 20, 1897. Comprises front and rear transverse members, each comprising two parallel tubes or bars lying in a horizontal plane and a pair of trussed arches extending between and joining the transverse members.

ELECTRIC RAILWAY. P. Preil, Washington, D. C., 611,271. Filed Dec. 30, 1897. Sectional conduit system.

MEANS FOR SUPPORTING ELECTRIC MOTORS. L. T. Pyott, Philadelphia, Pa., 611,273. Filed May 14, 1897. Embodies a cross-tie upon the truck frame, hangers upon the cross-tie and means to secure flexible motor suspensions removably to the hangers and to lugs upon the motor casing.

TROLLEY POLE. A. M. Meredith, Philadelphia, Pa., 611,367. Filed March 31, 1897. Consists of a trolley pole in sections, and a spring connecting the sections and allowing the end of one section to roll upon the one adjacent.

MOTOR MOUNTING FOR ELECTRIC CARS. S. H. Short, Cleveland, O., 611,461. Filed June 26, 1897. Employs a multipolar motor and an axle, and gearing connecting the same, the axle arranged to pass within the magnetic ring of the motor field.

ELECTRIC RAILWAY SYSTEM. G. L. Campbell, Dushore, Pa., 611,559. Filed Oct. 29, 1897. A closed conduit which may be operated by using a surface rail which is in short insulated sections and a trolley within the conduit.

Regulation:—

CONTROLLER FOR ELECTRIC MOTORS. H. P. Davis, Pittsburg, Pa., 611,465. Filed April 19, 1898. Embodies a two-part reversing-switch and means whereby either part of the reversing-switch may be disconnected from the other part and moved to such a position as to cut the corresponding motor out of circuit and prevent the movement of the main controller-drum beyond the positions corresponding to a series connection of the motors.

APPARATUS FOR STARTING MOTORS. J. Burke, New York, 611,558. Filed April 4, 1898. Comprises a converter in circuit with the motor and a supply circuit, and means for breaking the converter circuit at an intermediate speed of the motor.

Switches, Cut-Outs, Etc.:—

SAFETY-FUSE FOR ELECTRIC CIRCUITS. G. W. Gardanier, Nyack, N. Y., 611,243. Filed Dec. 16, 1897. Details of construction.

Telegraphs:—

APPARATUS FOR PRINTING TELEGRAPHIC MESSAGES. G. M. Gibson, Chulmleigh, England, 611,448. Filed Nov. 10, 1896. Details of construction.

Telephones:—

TELEPHONE SYSTEM. G. Ritter, Stuttgart, Germany, 611,581. Filed Feb. 23, 1895. Calling the central station is effected by merely taking down the receiver from its hook.

Raiding the Industrials.

The main feature of the past week has been the raiding of the "industrials" in Wall street, where speculation had carried the quotations of sugar, tobacco, etc., to dangerous heights. The whole market responded sympathetically to the break, but closed strong and stiff. If the industrials are to be mere footballs, they will soon be left to the professionals, and the investing public will have none of them.

The volume of trade throughout the country is very heavy, and business failures are at the lowest point for six years. In the metal industries there continues a demand of gigantic magnitude.

During the week, 7,865 shares of Western Union were sold, declining from 92⅛ to 90⅞. On sales of 6,550 shares, the new General Electric stock declined from 82⅝ to 79⅜. Metropolitan Street Railway on sales of 26,023 shares, rose from 155 to 157¼. New York Edison was stationary at 131. In Boston, American Bell Telephone was firm at 282 and West End Railroad steady at 85¾.

How Some Pennsylvania Townships Are Run.

Indifferent township officials in Pennsylvania are being rudely "schooled" by the courts in a knowledge of the responsibilities attached to their positions. In a recent charge to the grand jury Judge Yerkes, of Bucks County, gave warning to the Doylestown Borough Council that if they did not take action to secure a greater and better supply of water, for which the citizens are compelled to pay, he would present the officials to the grand jury. The authorities of Reading are under bail for maintaining highway nuisances, an indictment has been found against the Mayor and Councilmen of Carbondale on the same charge, and before Judge Bechtel, of Schuylkill County, last week, a jury awarded Lewis Draisbach $300 damages against the borough of Schuylkill Haven because the Councilmen permitted water to overflow a road near the plaintiff's premises to his inconvenience.

MR. HENRY HOPKINS, the well-known superintendent of city lighting at New Haven, Conn., has devoted considerable thought and attention to the problems connected with municipal lighting and the municipal plant question. At the request of The Electrical Engineer, he has kindly formulated his data and ideas, and will present them to our readers in a series of three articles, beginning next week.

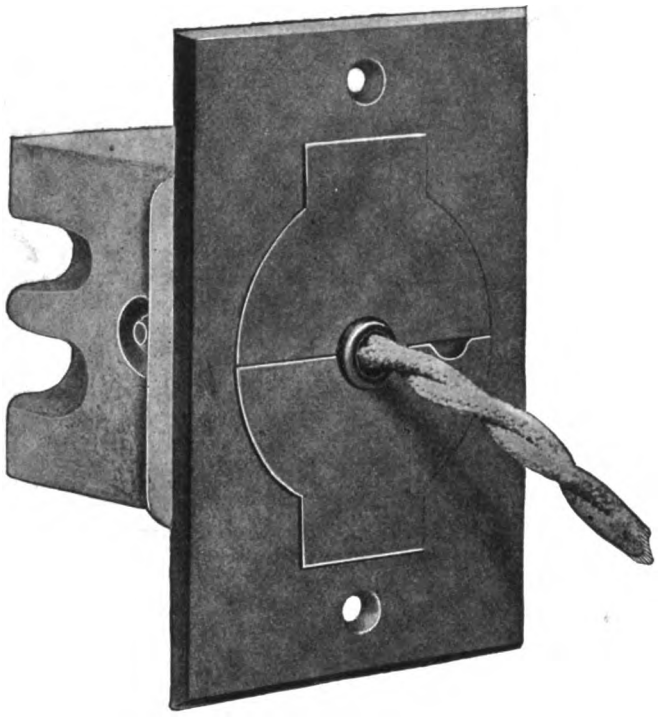
RICHMOND, VA., has been having trouble from electrolysis, and proposes to appoint a city electrician, who shall charm away the evil.

Digitized by Google

TRADE NOTES AND NOVELTIES

Zimdars & Hunt's Flush Plug Receptacle.

ZIMDARS & HUNT, the well-known manufacturers of high grade electric light and power specialties, of 127 Fifth avenue, New York, have just placed upon the market an article that embodies so many desirable features that it will not fail to be appreciated. This is a flush plug receptacle. While there are many plug receptacles on the market, they all have, it is said, the fault that the plug projects beyond the wall or floor line when the plug is in place, or connected. This is a great defect, as the projecting plug is not only unsightly in appearance, but is in constant danger of being struck and damaged by passing objects. As will be seen from the illustration, this plug receptacle is free from this fault, the plug when in place being entirely covered by the doors of the receptacle. This article presents practically the



ZIMDARS & HUNT'S FLUSH PLUG RECEPTACLE.

same appearance when the plug is in as when it is out. An extension on the plug acts as a bushing and prevents the cord from being cut when the plug is in place.

Besides this desirable feature the device has the following other advantages: It is easy to wire, large binding posts being provided. There are also slots and holes in the porcelain base large enough to admit of wire being looped in; it is made to fit standard iron boxes; has large, well fitting contacts always under tension; a porcelain barrier between parts of opposite polarity in the base elminating all possibility of accidental short circuits occurring.

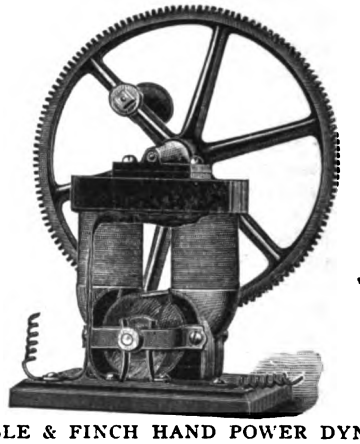
This device, is accurately and carefully constructed of the best materials and is absolutely high grade in every particular.

Carlisle & Finch's New Electrical Toys.

THE pioneer electrical toy manufacturers, the Carlisle & Finch Company, of Cincinnati, have added several entirely new features to their well-known products. The model railways have a steel track, hard chilled iron wheels, convenient and simple batteries. The entire outfit is so simple a child can set it up and operate it. There are no dangerous acids to destroy the clothes and carpet. The prepared compound is ready as soon as dissolved in water.

Of the hand power dynamos two sizes are made, the larger size being capable of delivering 15 to 20 volts and 1 to 2 amperes. The water-driven dynamos bid fair to be as great favorites as ever. The No. 8 is in great demand for running the model railways, and the hydro-generator is in general use charging storage batteries, running fan motors, etc. This latter will charge from two to six cells of storage battery at once. Doctors and dentists find it invaluable for keeping their batteries charged, as it may be run constantly without attention.

Besides the regular line of toys and dynamos, the Carlisle & Finch Company also furnish castings and parts for small dynamos and motors. A great many ingenious boys prefer to buy castings and build their own machines. The castings furnished



CARLISLE & FINCH HAND POWER DYNAMO.

are of electrical steel of highest magnetic permeability. They may be had in the rough or all finished ready for winding. The armature cores are furnished either as the pile of discs or assembled on the shaft and ready for winding. The commutators are finished and bored out to fit the shaft.

For show-window purposes there is nothing better than a model electric railway. The small stations, with automatic signals, operated by the cars as they move around the track, together with crossings, bridge and switches, add very materially to the realistic appearance of the scene.

Climax Resistance Wire.

Messrs. Welton B. Driver & Co., 126 Liberty street, New York, have taken the sole agency from John A. Roebling's Sons Co. for their Climax high resistance wire. This material has about 48 times the resistance of copper, and practically 3 times 18 per cent. German silver. Its temperature coefficient is .00042 per degree Fahr. There are but few places where this wire cannot be substituted for German silver to advantage. They will carry a stock of all sizes from No. 5 to No. 36 B. & S. It can be furnished flat and with cotton or silk insulation.

A. N. Palmer & Co., Baltimore.

A. N. Palmer & Co., 219 East Baltimore street, Baltimore, Md., are jobbers of electrical merchandise, and claim to be the only electrical house in Baltimore confined solely to the supply business. They also have a branch house in Norfolk, Va., so that Southern orders can be promptly filled. The range of goods includes street railway supplies, household electric supplies, street lighting supplies, and telephone supplies. They make a specialty of the Sumter telephone. They also handle the products of the Phillips Insulated Wire Company, the New York Insulated Wire Company, and the Perkins Company, and include lamps, switches, porcelain goods, and Lundell fans and motors. The demand for telephones, especially through the South, is increasing rapidly, and the principal demand comes from farming sections. Many planters whose houses are located at some distance from town or railroad stations are coming together to share the expense of putting up the poles and wires. The instruments are connected in series, saving the expense of an exchange, and making the cost very light for each subscriber. A line of 20 miles was recently erected and equipped with instruments bought from the Palmer Company at a cost of $27.50 for each subscriber, the work of setting the poles and stringing the wires having been done by the individuals along their respective plantations. By

Digitized by Google

this means the planters are able to keep in touch with market prices; they can also order goods when required, and use the telephones for social as well as business purposes.

The Victor Straight Metallic Express Switchboard.

The Victor Telephone Manufacturing Company, of Chicago, have reeently placed on the market a new express switchboard, for which such extraordinary claims are made as to place it, if realized, among the greatest improvements in modern telephone practice. There are no wires running into the jacks and one strong spring serves the purpose of all jack connections. Other claims are simplicity and stability of parts, durability, ease and rapidity of operation and economy of maintenance. The company have already received a number of orders for these new and improved switchboards.

CATALOGUES.

Western Telephone Construction Company.

Among manufacturers of independent telephone apparatus there is perhaps no name better known than that of the Western Telephone Construction Company, 250 South Clinton street, Chicago, Ill. For a number of years they have kept pace with the rapid development of independent telephony, and have placed upon the market a line of goods of superior quality and high grade. Each year their catalogues contain a larger number of telephone apparatus and new types to correspond with the most recent development in the telephone field. Their latest catalogue, which contains 136 pages, reflects great credit on Mr. J. E. Keelyn, president, and his able staff of officers and assistants. The catalogue is amply illustrated, showing the various departments in the shops of the company, as well as the various apparatus constructed by them, and diagrams of circuits, showing how they should be installed. Among the apparatus shown the following deserve special attention: All kinds of exchange and private switchboards, equipped with improved, combined, self-sustained, removable spring-jacks, drops and coils. These are embodied in all their express switchboards. Switchboards for toll line service, distributing and testing boards, are also shown in a number of types, and all contain many desirable features. There are also shown the company's well known lightning arresters, power and hand generators, transmitters, receivers, induction coils and batteries, all of which have been illustrated in our columns from time to time. The company also manufacture police, fire alarm and railway patrol boxes, linemen's testing sets and portable desk telephones. The catalogue which will be sent free to any one on application, contains besides many interesting chapters on the progress of independent telephony.

Electric Street Railway History.

This is the title of a very interesting historical treatise on electric street railway development and the part played therein by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. This company have issued much admirable literature of late. The book, which is called "Part One," is bound in a handsomely ornamented electric blue cover. "A Word at the Start" tells us about the rapid development of the electric street railway industry and remarks that no name is more intimately associated with this swift and world-wide progress than that of the Westinghouse Company. The history begins by showing illustrations of the No. 1 motor, introduced early in 1890 in Allegheny, Pa. Then follow in order the No. 3 motor embodying single reduction gears, 4-pole field, slotted drum armature, machine wound armature coils, and two circuit armature winding; we are then told something about the No. 12 motor having fewer parts than the No. 3, and the armature of which was the first to have twice as many coils and commutator bars as slots, a feature which now represents universal practice. Then a word is said about "suspension," which was recommended for the No. 38-B motor; No. 50 motor embodied all the latest improvements developed during a number of years of motor manufacture, which is responsible for the remarkable record of 19,000 Westinghouse railway motors in service at the present time, with an aggregate capacity of 650,000 h. p. Following this are extensive chapters on Westinghouse railway generators and Westinghouse alternating-direct current system of power transmission for railways. The illustrations in the book consist of a view of the factory and a number of views in the works, over thirty illustrations of motors and parts, a number of generators, switchboards and transformers, as well as several installations of Westinghouse apparatus. The catalogue will be sent to any one on application.

The Palmer Gas and Gasoline Engines.

These engines, manufactured by the Mianus Electric Company, Mianus, Conn., have recently found extensive application in a number of isolated plants. The catalogue which has just been issued by that company fully describes the details of the Palmer gasoline engine, the Palmer stationary engine, the various parts used in their construction, and a number of launches equipped with them. This catalogue and any further information will be gladly furnished by the company.

THE ELECTRIC APPLIANCE COMPANY have just placed in the printer's hands copy for their new telephone catalogue. They claim that this will be the best all-around telephone apparatus and supply catalogue that has so far been issued. It will be ready for distribution in the course of a few weeks and telephone companies are advised to send in their applications now, so that their names may be placed on file and the catalogue may be sent as soon as it comes from the press.

ADVERTISERS' HINTS.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, are preparing a catalogue of telephone supplies. It will be ready shortly and may be obtained as soon as issued by those who send their names in now.

THE ELECTRIC ARC LIGHT COMPANY, 120 Liberty street, New York, claim the "Pioneer" enclosed arc lamp is the standard, embodying the best mechanical design and the highest electrical efficiency.

THE GARVIN MACHINE COMPANY, Spring and Varick streets, New York, have just issued a new catalogue of machine tools for every purpose. Their prices are new, too.

J. JONES & SON, 62 Cortlandt street, New York, have something to tell about their knife switches.

JULIUS ANDRAE & SONS COMPANY, Milwaukee, Wis., say that when better telephones than the Andrae are made, they will be the ones to make them.

JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., say: "You cannot become an electrical engineer unless you are willing to use Roebling rubber insulated wire."

VANCE ELECTRIC COMPANY, 136 Liberty street, New York, are devoting special attention to all kinds of marine work.

THE ELECTRIC STORAGE BATTERY COMPANY, Drexel Building, Philadelphia, Pa., submit a list of electric railway plants equipped with "Chloride Accumulators." The list is a large one and argues well for the efficiency of storage batteries in railway service.

THE CARLISLE & FINCH COMPANY, 830 West Sixth street, Cincinnati, O., carry a very full stock of electric toys, hand dynamos, water dynamos, fan motors, etc. Their catalogue "D" describes these goods fully.

F. A. LAROCHE & CO., Thirteenth and Hudson streets, New York, have recently installed some handsome switchboards, one of which is illustrated in their "ad" in this issue.

THE CROUSE-HINDS ELECTRIC COMPANY, Syracuse, N. Y., advertise switches.

THE BEACON LAMP COMPANY, New Brunswick, N. J., call attention to the high vacuum in their lamps and the freedom from blackening.

SOCKETS, switches and cut-outs are the staples of the electric business and the demand for them comes from every class of trade. In order to meet this demand and give the customer just what he wants, the Western Electric Company has put in a varied supply of these articles.

Digitized by Google

NEW YORK NOTES.

CLONBROCK STEAM BOILER WORKS, Lorraine street, Brooklyn, report running their works at the present moment night and day. They have installed their boilers in many large power plants, which have given excellent satisfaction. The new catalgoue on their boilers has recently been issued and will be mailed to any address upon application.

WILLIAM ROCHE, 259 Greenwich street, manufacturer of new standard dry cells, is not only pushing his large size batteries for telephones, railroad signals, gas engine ignition, etc., but is now offering the trade a so-called "miniature" battery, oval 1⅝ by 1⅛ by 3½ inches over all, which is specially intended for necktie pins, cataphoresis and many other like and unlike purposes. These small batteries are put upon the market to take the place of acid batteries which are so often objected to as dangerous. The Roche No. 2 cell is just now awakening considerable interest among telephone people.

M'LEOD, WARD & CO., 27 Thames St., New York, report meeting with unprecedented large sales of their Kinsman desk lamps and portables. Their Ward Orchestra lamps for the use of orchestras, theatres, pulpits, church organs and music racks are also meeting with a large demand from all parts of the country. McLeod, Ward & Co. take pleasure in mailing a pocket catalogue to any address upon application.

LOWVILLE, N. Y. The Wetmore Electric Co., which does a business in light and power in the towns of Lowville, New Bremen and Croghan, has organized with a capital stock of $40,000. G. W. Pulver, of Syracuse, is president. The system is Westinghouse, two-phase, with converters of 250-kilowatt capacity and lights of 325-h. p. capacity. There are eleven miles of circuits.

THE NEW FIRM of Hochhausen & Hall are prepared to furnish promptly parts of machines and execute general construction and repair work of all kinds. Their offices are located at 67 Liberty street, Brooklyn, N. Y.

THE JOHN A. ROEBLING'S SONS COMPANY report the placing of a large number of orders for rubber insulated wire, which will be filled by the product of their new rubber insulating plant. This mill has been in operation but a short time, but was exceedingly fortunate in running to its full capacity from the very start. A very high grade of material is being manufactured, and its favorable reception presages the enlargement of the plant beyond the expectation of its owners.

NEW ENGLAND NOTES

DANBURY, CONN. An explosion of gas occurred on Sept. 23 in the works of the Danbury & Bethel Gas and Electric Light Company, but no one was injured. The damage is put at less than $2,000.

WESTERN NOTES

MICHIGAN ELECTRIC COMPANY, Detroit, Mich., had its place of business destroyed by fire on Sept. 24, since when it has leased temporary quarters at 106 Woodward avenue, that city, and will carry on its affairs as usual. It has ordered fresh material, etc., to fill orders on hand, and expects shortly to be in better shape than ever. Mr. J. E. Lockwood is president of the concern, and Mr. Geo. A. Mansfield, treasurer.

THE EUREKA BLOW PIPE adapted for either gasoline or kerosene is a convenient and durable tool. It is specially adapted for soldering, light brazing, burning paint, melting metals, heating soldering irons and other purposes, all of which are described in the neat little circular recently issued by the Western Electric Company.

ELECTRICAL EXCHANGE ASSIGNS. The Electrical Exchange, which, since November, 1896, has been engaged in the sale of electrical apparatus and supplies at 174 Clinton street, Chicago, has made an assignment for the benefit of its creditors to L. O. Gilman. The assets and liabilities of the company are estimated at $12,000 each. The firm has dealt largely in second-hand dynamos. The officers of the company are: President, T. S. Lane; secretary, R. R. Lane; treasurer, H. L. B. Cannon.

FOREIGN NOTES

MR. ALFRED J. THOMPSON has now established himself at San Ignacio 50, Havana, Cuba, where he is representing the Edison specialties, the Elmer P. Morris lines, Crocker-Wheeler Company, Stanley Company, McIntosh, Seymour Co., and Sterling Arc Light Company. He is busy on new installations and repairs, and will be glad to hear from other responsible parties desiring to place exclusive agencies in Cuba.

MR. JOHN CASSIDY, superintendent of the Mutual Telephone Company, of Honolulu, S. I., is on a brief visit home with the object of securing a new plant for the Bell telephone system there. He has long been connected with electrical interests in this country and the Sandwich Islands, and takes a very hopeful view of the prospects under annexation.

CONTENTS.

EDITORIALS:
The Photometry of the Enclosed Alternating Arc 338
The Application of Alternating Currents to Electric Traction..... 338
Tornadoes and the Niagara Line 339
Wind Power as a Source of Electrical Energy 339
Exhaust Steam from Central Power Plants 339

POWER TRANSMISSION:
Electric Dumb Waiters in the Chicago Public Library (illustr.)... 329

MISCELLANEOUS:
Electrical Refrigeration—I. (illustr.) .....Thomas J. Fay. 331

ELECTRIC TRANSPORTATION:
The International Trolley Crossing at Niagara Falls (illustr)..... Orrin E. Dunlap. 332
An Electric Aerial Railway Between Elberfeld and Barmen, Germany (illustr.).—Horseless Carriage Motors for the Electric Vehicle Co., New York (illustr.) 333
By-Products of Power Plants .....Dr. M. M. Fenner. 334
Individual Fare Boxes 337

ROENTGEN RAYS:
X-Ray Work in Baltimore (illustr.) 340

LETTERS TO THE EDITOR:
The Recent Strike in the Bullock Factory ..... J. S. Neave, Vice-President. 342
Easy Testing of Arc Light Circuits .....J. F. Stevens. 342

TELEPHONY AND TELEGRAPHY:
An Arrest by Telephone at New Brunswick, N. J.—Bell Telephone 342

ELECTRIC LIGHTING:
Switchboards in the New Buildings in New York City (illustr.).—The American-Indies Co. 343
The Goughnour Dynamos and Motors (illustr.).—E. M. F. of the Arc with Aluminum Electrodes.—G. E. Brush Single and Double Carbon Arc Lamps (illustr.) 344

SOCIETY AND CLUB NOTES:
Eighth Annual Meeting of the American Electro-Therapeutic Association, Buffalo, N. Y., Sept. 13, 1898 346
American Institute of Electrical Engineers.—Municipal Electricians' Association.—Opening of the Twentieth Triennial Exhibition of the Massachusetts Charitable Mechanic Association 348

EDUCATIONAL:
Electrical Instruction by Mail in New Jersey 348
Educational Work of the Young Men's Christian Association.... 349

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Sept. 27, 1898. 349

MUNICIPAL AFFAIRS:
How Some Pennsylvania Townships Are Run.—Milwaukee Electric and the Politicians 349

THE STOCK MARKET:
Raiding the Industrials 349

TRADE NOTES AND NOVELTIES:
Zimdar's & Hunt's Flush Plug Receptacle (illustr.).—Carlisle & Finch's New Electrical Toys (illustr.).—Climax Resistance Wire.—A. N. Palmer & Co., Baltimore 350
The Victor Straight Metallic Express Switchboard.—Western Telephone Construction Co.—Electric Street Railway History.—The Palmer Gas and Gasoline Engines.—The Electric Appliance Co.—Advertisers' Hints 351
New York Notes.—New England Notes.—Western Notes.—Foreign Notes 352

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. OCTOBER 13, 1898. No. 545.

MISCELLANEOUS

Electrical Refrigeration—II.

BY THOMAS J. FAY.

HAVING thus gone into the question of details of performances enough to clear the atmosphere in a measure adequate, no doubt, for this purpose, it may be well to proceed with the main thread of the theme. Therefore, it may be well to say, first, that this first machine would not be considered a commercial success, primarily because the gear made noise such as would not be approved by an "army mule," who is indeed a patient ass. Second, the machine looked like an antiquated burial casket, and finally, the vitals were entirely too inaccessible, it requiring the better portion of a day to get at the seat of any trouble sure to arise sooner or later.

Therefore, to obviate these difficulties, the author designed the type of machine Fig. 5, which was intended to keep within the limits not involving a stuffing box yet at the same time place the electrical apparatus above board and free to be inspected at will, all of which was accomplished by the utilization of a worm gear and a magnetic transmitter, so arranged that a compressor, within an hermetically sealed chamber, was driven by an electric motor without, substantially in the manner as indicated by the cut.

There have been two of these machines built, one in the C & C shops, using a single worm gear, with a 15 h. p. motor, and if the writer remembers correctly, 12"x12" duplex single acting cylinders. The writer, however, knows nothing of the performance of this machine. The other machine, however, was an 8"x8" duplex single acting compressor and was built in the shops of the Crocker-Wheeler Electric Company, and thereafter set up in the Plymouth Market, Brooklyn, N. Y. At first the equipment refused to perform, for the following substantial reasons, viz.:

(a) The moving parts of the compressor were too tight.

(b) The dome of the compressor leaked gas, somewhat after the fashion of the Government dry dock at the Brooklyn Navy Yard, which leaks anything from a battleship to a cork.

(c) The transmitter gave more trouble than it was really worth, mostly because it was the first one of the kind and built before

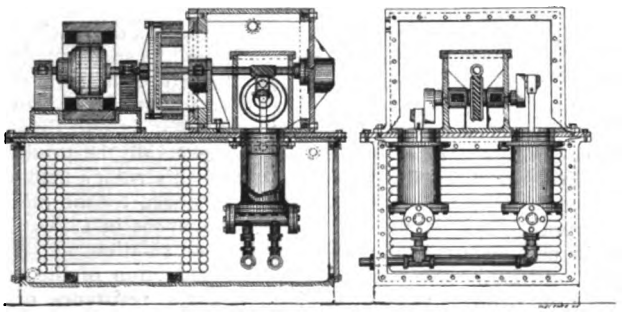


FIG. 5.—LONGITUDINAL AND VERTICAL SECTIONS OF ELECTRICAL REFRIGERATING MACHINE.

knowledge could be gained of a nature adequate to the occasion.

The motor was a 10 h. p. bipolar Crocker-Wheeler, horseshoe type, with an armature speed of 1,200 revolutions per minute, and, if anything, was too large for the work; in fact, a 7½ h. p. motor at about from 900 to 1,000 revolutions per minute, would suffice. The dome was closed up by solder and finally became tight. The compressor moving parts were given adequate clearance, and then worked very well indeed. The transmitter was fussed with for about two months, and was finally made to work all right after casting out the gutta-percha diaphragm, which seemingly had a knack of bending in any direction at the slightest provocation after having been in contact with sulphur dioxide. Flint glass was substituted and never gave any trouble beyond the fact that it introduced an annoyance at first because the transmitter was not proportioned for it and the clearance was not sufficient. Yet do I think the experiment was worth the candle, and should a new one be built, then by paying attention to the matter of the diaphragm, clearance and motor speed, the result would be commendable to a degree.

The cut Fig. 5 does not show a C. W. motor, nor does it show

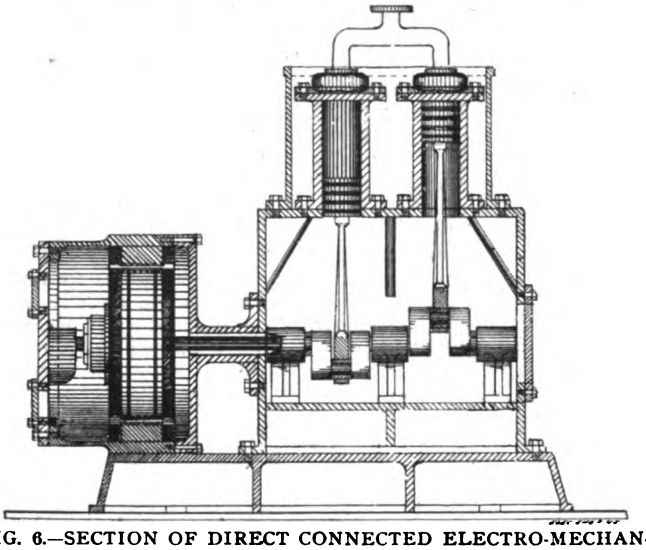


FIG. 6.—SECTION OF DIRECT CONNECTED ELECTRO-MECHANICAL REFRIGERATING MACHINE.

windings of the "transmitter," which windings were on the outer ring, and for this size machine there were about 10,000 ampere turns, all of which, however, is unimportant for this purpose.

The reason why a dielectric diamagnetic diaphragm was used between the two members of the transmitter is obvious to an electrical student. If not dielectric Foucault circuits would abound. If not diamagnetic the demagnetizing effect would affect the magneto-motive force in a major measure.

A test of this machine after having operated for about two months directly under the writer's supervision showed the following average results:

Test—Size of motor, 10 h. p.; size of compressor, 8"x8" duplex single acting; speed of motor, 1,200 revolutions per minute; speed of compressor, 79 revolutions per minute; e. m. f. of circuit, 230 volts (Edison supply); current to motor, 28 amperes; horse power applied, 8.63 electrical; current required for transmitter, 2½ amperes; power required for transmitter, .772 h. p.; power required for motor only, 7.858; efficiency of motor, 85 per cent.; b. h. p. of motor, 6.679 given load; efficiency of transmitter 88.4 per cent. given load; compressor displacement, 36.5 cubic feet per minute; gas return pressure, 14.7 pounds absolute per square inch; gas condenser pressure, 75 pounds absolute per square inch.

Conclusions—(a) The motor was too large for the work and would be productive of even more efficient result if a 7½ h. p. motor were used. (b) The transmitter was poorly designed for a glass diaphragm, and would be more efficient if altered in some respects. (c) The gear was a good success. (d) The valves worked well at all times. (f) The casting should be of the following mixture, i. e., charcoal iron, 60 per cent.; scrap (home), 25 per cent.; steel, 15 per cent.; total, 100 per cent.; and on chemical analysis of such castings should show components about as follows: Graphitical carbon, c.; 2.80, combined carbon, c.; .71 silicon, si, 1.30; sulphur, s. .133; phosphorus, p. .155; manganese, mn. trace; iron, fe difference; total, 100 per cent.

Such a mixture would possess advantages as folllows: (a) Impervious to leakage of gas, (b) tensile strength of 24,000 pounds per square inch, (c) practically no chill, (d) not difficult to machine, (e) advantageous shrink, (f) free from "shot" and other defects, (g) castings of average cost, (h) castings which moved

Digitized by Google

well. The ordinary foundry castings thus far used possessed but few of the above advantages and were sources of great annoyance, thus retarding the progress. Whereas, castings as above outlined were found since by the writer to be very advantageous in all particulars. It is a fact, however, that semi-steel castings can only be had in batches enough to charge a cupola, because steel in the mixture is subject to segregation, and the metal must be mixed in the ladle, else the steel will not be uniformly disposed.

After having gone through the experiments with refrigerating apparatus as above outlined, it was decided to try another type of machine (see Fig. 6), and with this in view a 6"x8" duplex single acting compressor was designed and built in the shops of the Clayton Air Compressor Works, with an electrical motor for the same furnished through the courtesy of Mr. A. Churchwood, of the Excelsior Electric Company. This machine was designated a direct connected type and the motor was designed to run at the same speed as the compressor cranks, i. e., 90 revolutions per minute. The motor hardly needs much description, as it was of the Churchwood slow speed multipolar type, rated at 5 h. p. The compressor was substantially the same as those before built, less the reducing gear and separated from the condenser. The motor was closed up at both ends (so called iron-clad) and the motor shaft passed through a tunnel or tube to the compressor shaft. Thus did the refrigerant have access to the motor just as in the case, (Fig. 1), but the motor could be examined readily as hand holes (to get at brushes) were provided and arrangements whereby the gas could be exhausted from the motor in a few moments were provided. This type of apparatus promised most of all thus far attempted, and this machine certainly did its work in a peerless manner, although the same old question of castings

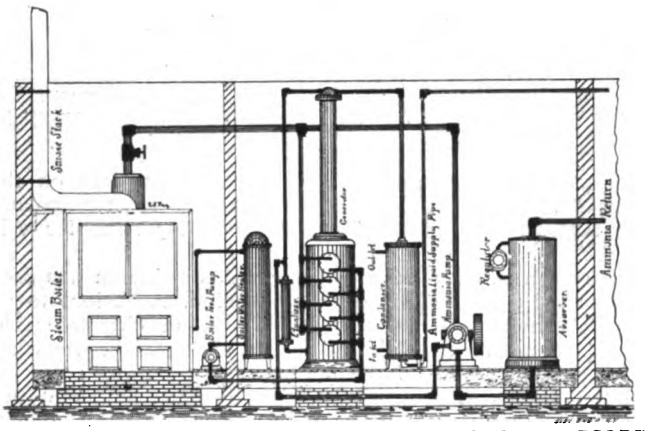


FIG. 7.—GENERAL ARRANGEMENT OF THE AMMONIA ABSORPTION SYSTEM.

bobbed up serenely, thus emphasizing the fact that ordinary metal is as porous as an oyster's brain is of dubious caliber.

In this machine the valves were of the Clayton type, and we found that areas adequate (no doubt) for air were not so for sulphur dioxide, so that the valve areas were augmented; that is, new and larger valves were substituted, after which the electrical energy needed was that presumed to be right, instead of a greatly increased amount under the wire drawing effect of valves of insufficient area. A test of this machine was as follows:

Compressor, 8"x8" duplex single acting; speed of crank, 90 revolutions per minute, motor, 5 h. p. rating; speed of shaft, 90 revolutions per minute; e. m. f. of supply, 230 volts; current, average, 15 amperes; motor efficiency, 72 per cent.; power delivered by motor, 3.33 h. p.; displacement of pistons, 23.5 cubic feet per minute; gas return pressure, 14.7 pounds per square inch absolute; gas condenser pressure, 65 pounds per square inch absolute.

Conclusion—First cost of motor, very great; efficiency of motor, very low, both of which points form a comparative point of view; ultimate efficiency, very good; ultimate first cost, very low, the reason for which lies in the fact that no gear is required and the cost of the compressor thereby reduced, whereas, the loss in a gear is greater than the difference between the efficiency of a motor of this speed and a high speed motor.

The appearance and compactness of the outfit is in its favor. The probability of interruption, due to wear, tear and inaccessibility, below that in other types experimented upon thus far.

The writer will proceed in a somewhat different direction for a space with a view to a comparison, as for instance:

Fig. 7 shows a view of an absorption system of refrigeration, in which the various parts are given space, and after a glance at the cut it need hardly be said a marketman would ill find space in a city store for so much paraphernalia, lest the product dealt in be sent to a cold storage and the cashier sent on a prolonged vacation. Yet this absorption system of refrigeration is the only other method not involving a stuffing box and its accompanying leaks. In this system advantage is taken of the affinity of ammonia and water, and the ammonia gas, after having been expanded from the liquid, is brought back to an "absorber," where it combines with "mother liquor" from the "generator," and is then pumped into the "generator," where, by means of heat supplied by steam from a boiler (the ammonia is driven off, and after passing thence to the condenser, it there ready for use again after liquification, the mother liquor going back to the absorber to renew its sponging process). No comment will here be made on the efficiency of the system. Enough to say that it is used in ice making on a large scale. But for marketmen it is like the blind eye of a tiger—however formidable the tiger, the blind eye is, in the language of the learned M. D., an appendix vermiformis.

There are other schemes, of course, but they fail to abound in that healthy state which practice demands, as for instance, chemical ice, not impossible, however impracticable, is good bait, and has been used by more than one fisherman. The writer has referred to this system as the presto-chango system of refrigeration, because the fisherman baits his hook with a revised edition of this scheme and catches a sucker; then, presto-chango, the sucker's money goes into the fisherman's pocket and the cycle is complete. In all seriousness, however, 'tis not new to produce low temperatures by combining with hydric oxide some of the elements not akin to acids, which raise the temperature instead of lowering it. The only practicable system the writer knows aught about is that before described as the absorption system.

NOTE.—The refrigerating machine shown in Fig. 1, Part I., was designed by Mr. W. F. Singer.

Apparatus for Measuring Coefficients of Self-Induction.[1]

BY S. T. MORLAND.

THE apparatus consists (1) of two rectangular coils of wire, the coils being very nearly alike, except that one of them is short enough to be placed inside the other. The coils are placed with their planes at right angles to each other, and have a common space inside, the two having the dimension 1½" x 1½" x 3½". (2) In this common space is a delicately suspended hollow conducting cylinder as large as can be made to turn with freedom. A small mirror is attached to the support of the cylinder and a lamp and scale are used to detect any motion of the cylinder. If a divided alternating current be sent through the two coils a rotary magnetic field will generally be produced in the space occupied by the cylinder, and this rotary field will cause the cylinder to rotate, as will be evidenced by the motion of the spot of light in the scale. The resistances in series with the coils may be so adjusted as to produce no rotation.

If L_1 and L_2 be the coefficients of self-induction of the coils and r_1 and r_2 their resistances, including the resistance of all conductors in series with them, then the condition for no rotation is $\frac{L_1}{r_1} = \frac{L_2}{r_2}$. Now r_1 and r_2 may always be adjusted to make this rotation hold. We suppose the value of L_2 to have been previously determined by some independent method. The equation gives $L_1 = \frac{r_1}{r_2} L_2$, and hence L_1 may be determined by measuring r_1 and r_2. Now, if any coil L_3 and r_3 be put in the series with the coil L_1 r_1, the condition for no rotation is $\frac{L_1 + L_3}{r_1 + r_3} = \frac{L_2}{r_2}$, but since $\frac{L_1}{r_1} = \frac{L_2}{r_2}$ we must have $\frac{L_1}{r_1} = \frac{L_3}{r_3}$ or $L_3 = \frac{r_1}{r_3}$. If L_1 be known, L_3 may be found.

[1]Read before the A. A. A. S. Abstract.

Digitized by Google

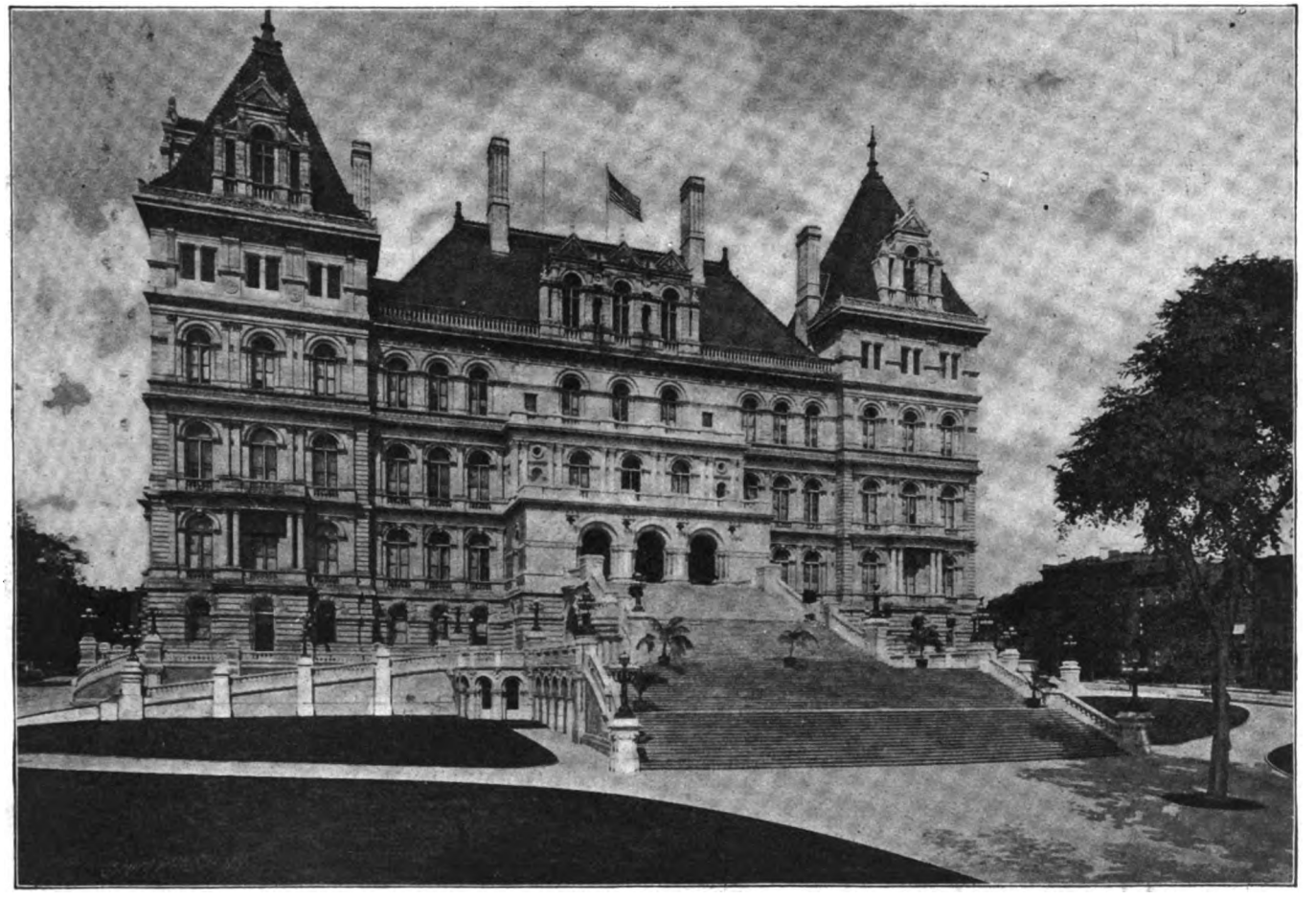
ELECTRIC LIGHTING.

Wiring the New York State Capitol.

THE erection within recent years of hundreds of tall office buildings, in the planning of which a minimum of ground area and a maximum of height have been reached, has had a decided and beneficial effect on many important branches of the electrical industry. Foremost among these is the art and practice of electric wiring, which had presented to it new and difficult problems requiring immediate and practical solutions. The network of conductors had to be as carefully calculated and mapped out as was that required for the distribution of light and power through the streets of our cities, except that the problem became more complicated on account of the lack of room and necessity of æsthetic arrangement.

One of the most striking among these operations, and one which stands out in strong contrast to the time required to complete the magnificent building itself, is the wiring contract lately carried out in the New York State Capitol by the E. G. Bernard Company, of Troy, N. Y. This piece of work was noted recently in our pages. Before giving the details of this interesting installation it may be of interest to give a few facts about the Capitol itself. At the outset it may be stated that this building stands unsurpassed and unparalleled in magnificence and splendor by any public building in this country, also in the amount of time and money spent on its execution.

The Capitol of the Empire State is the most imposing building in Albany and commands the finest site. Perched upon the highest of the several hills upon which Albany is built stands this gigantic structure of white granite, with red-capped towers. Large as it is, its size is exaggerated into immense proportions by its elevated position. The old Capitol of the State, which stood in the little Capitol Park, just east of the present new Capitol, was constructed in 1806 at a cost of only $110,000. It was occupied until 1879, when the Legislature moved into the present magnificent structure. The new Capitol up to the close of the fiscal year ending September 30, 1898, had cost the sum of $24,236,562.80, and probably $500,000 will still be required to finish it. It will be instructive to compare this building with others. The Capitol at Albany is 300 feet north and south by 400 feet east and west, and with its porticos will cover three acres. The walls are 100 feet high from the water table. The Capitol at Washington covers a little over five and one-half acres, is built of marble and sandstone, painted white, and the art work on it cannot be surpassed. It cost altogether $11,725,478. The public buildings at Ottawa, three in number, are massively built at a cost of about $5,000,000. The Michigan State Capitol is 345 feet in length by 191 feet in depth, and extreme height to the top of the dome, 267 feet. It covers one and one-sixth acres and cost $1,430,000. The new capitol at Hartford, Conn., is a fireproof building of white marble. Its size is 295 feet front by 187 feet deep; total height to the top of the crowning figure, 256 feet; cost, $2,256,140.



THE NEW YORK STATE CAPITOL.

Pages and pages of interesting matter could be written about the details of this wonderful structure, its chambers and halls, its staircases and library, the material used in its construction, the men employed, its history and commissioners, but this space alone forbids. One of the latest chapters in its history is the story of the electrical work recently completed.

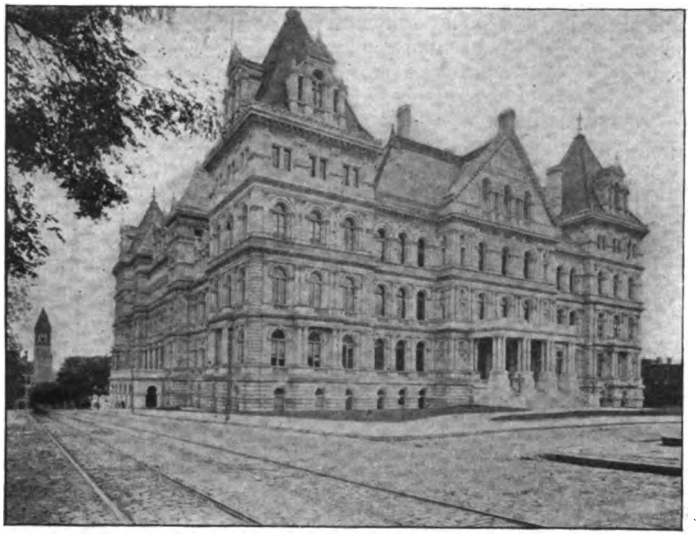
Upon every available post on the east and west entrances to the building and at the north and south terraces have been erected handsome bronze electroliers of the newest and most artistic designs, from which will depend numberless incandescent lamps, giving to the handsome granite structure a very imposing effect.

Inside the building the grand western staircase will be lighted by 1,400 lamps, which show to the fullest extent the beauty of that structure. New electroliers, manufactured by the Mitchell-

Digitized by Google

Vance Company, New York, also have been placed in other parts of the building.

On the two lowest newel posts at the eastern approach have been erected two 50-light standards of bronze. These are handsome in design and weigh about one ton each. On the posts on either side of the first landing also are placed two large electroliers. These electroliers are composed of three standards, one



NEW YORK STATE CAPITOL.

large and two smaller. They contain about 40 lights and weigh almost as much as the others. Two stories above there are also tri-standard electroliers of 40 lights each. On the north and northeast terrace are six 30-light electroliers on the larger posts and the same arrangement was followed on the other side of the building. On the alternate posts on the north and south sides of the building are ten 15-light standards, somewhat smaller than the standards on either side of the western approach.

There are 42 small standards on the balustrades and landings of the grand western staircase. These are of four different classes in their design. At the landings on the third and fourth

MAIN STAIRCASE, NEW YORK STATE CAPITOL, SHOWING LIGHTS.

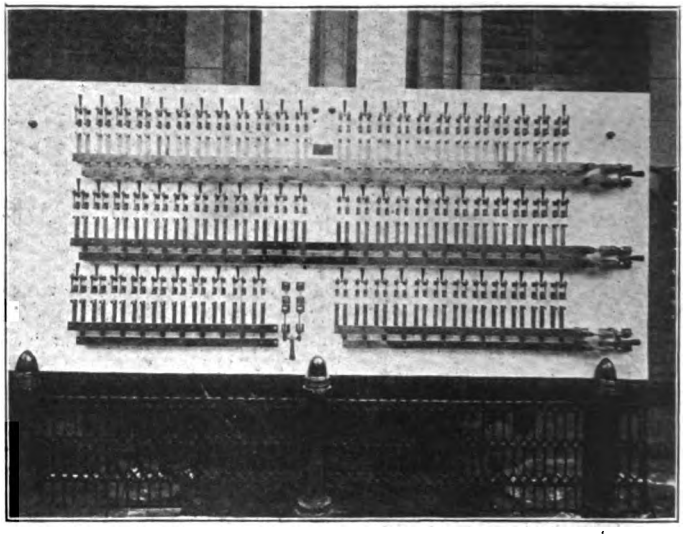
floors there are fourteen 10-light hanging brackets, umbrella-shaped.

Above the ground-glass skylight over the grand western staircase have been placed 1,100 electric light globes. Along the staircase have been placed 1,300 globes. The staircase appears to be one mass of light when the current is on.

In the lobby of the western approach have been placed six 50-light electroliers. These are suspended from the ceiling—three in front and three in the rear of the lobby. About one hundred other electroliers have been placed in various parts of the building. The most of these have been hung in the western end of the building and in the tower.

The approaches are lighted by 1,500 incandescents and the driveway by six arc lamps, 500 extra lights having been placed in the library extension. The total number of lights now in the building is over 12,000, of which about 6,000 were installed during the past fifteen years, from time to time. As interesting as these figures are themselves is the manner in which the E. G. Bernard Company carried out the contract of wiring, including the switchboard, located in the dome room, and shown in the illustration, the mains, feeders, branches, etc. The contract included over 6,000 lights. The firm undertook to do the job in thirty working days and finished with five days to spare, although ninety days were asked by other concerns, and Mr. Perry, the State Architect, regarded sixty days as the limit. One of the main features was the drilling of about sixty newel posts of Hallowell granite. Within twenty-fours hours after the receipt of the order the Bernard Company had seven steam drills at work, and this task was accomplished in about eighteen days. In each post a vertical hole from 9 to 17 feet long and 2 inches in diameter had to be drilled and to be met exactly by a horizontal hole from 4 to 8 feet long and drilled in a duct hardly large enough for a man to crawl into.

All wire used on the job was special, so that no standard marketable size could be used for the heavy work. In this installation the Bernard Company employed about 75 men, and it was



SPECIAL SWITCHBOARD IN N. Y. STATE CAPITOL, IN THE DOME ROOM.

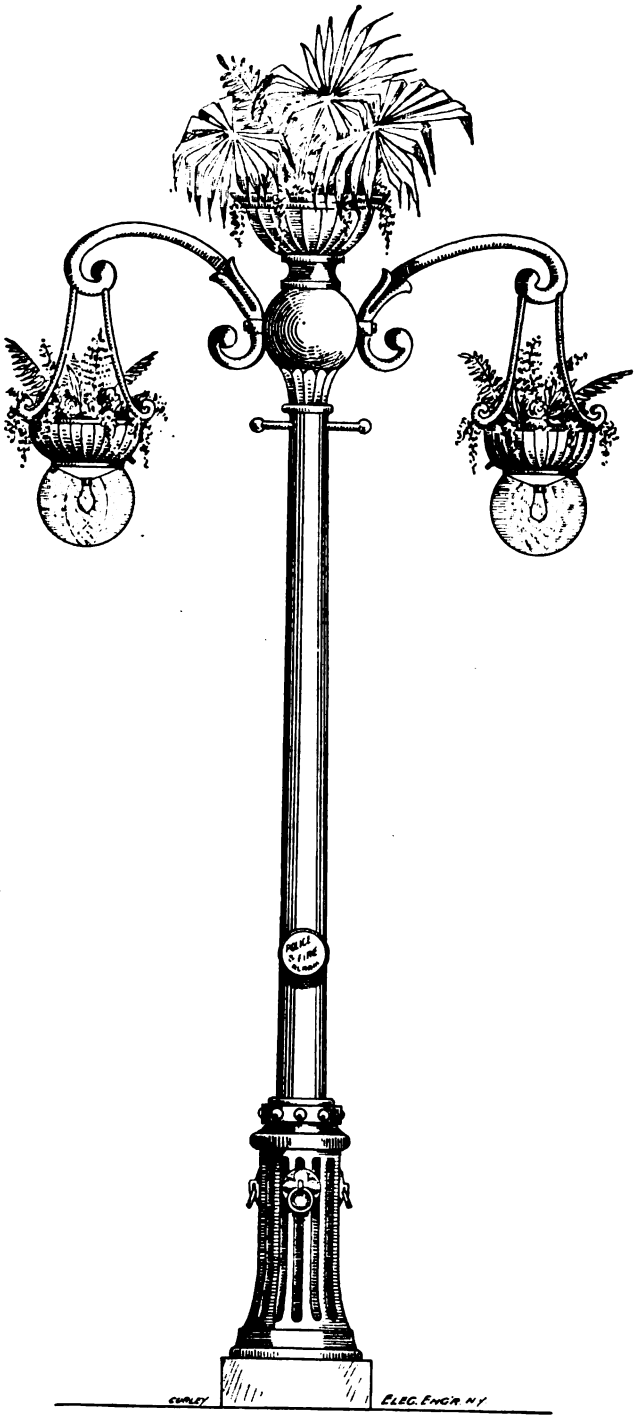
a case of rush from beginning to end. This record is a striking proof of the ability of the Bernard Company to handle large and special work in their line in the shortest possible time limit, and there can certainly be no red tape in their management, or work of this magnitude could not be accomplished in so short a time, especially when all wire and other factories were rushed to their utmost capacity with Government orders. The Bernard Company claim they could have finished the work in twenty days if standard goods had been specified. They also claim this is the largest and most difficult contract for concealed work in a finished building ever executed in the United States.

AN ELECTRICAL "HOLD-UP." Max Cohen, of Philadelphia, came to New York City to see the sights. He saw an electric battery at Rivington and Orchard streets, and he paid 5 cents to find out how much electricity he could stand. While the current was turned on, Louis Levy, who stood alongside of Cohen, helped himself to Cohen's gold watch and chain. Cohen wanted to prevent Levy from taking his timepiece, but because of the current being turned on he could not release his hold of the handles of the electric battery. When he finally got away he gave chase to Levy, who fled to the roof of a tenement, where he was arrested. Magistrate Mott committed Levy for trial in default of $1,000 bail.

Digitized by Google

The Lieb Park Lamp Post.

THE accompanying illustration shows a park lamp post designed by Mr. Charles A. Lieb for use by the Cleveland Park Land Company, of Washington, D. C. This company are developing near the national capital a very picturesque park area reached by the trolley roads from the city and neighboring towns. The posts used at present are both unsightly and unsatisfactory, and the one here shown combines with attractiveness



LIEB PARK LAMP POST.

all the requirements of modern street light fixtures. It is surmounted, as is also each lamp, by a removable metal basket containing ferns and plants, which have a comparatively long life and only need replenishing, perhaps twice a year, at a very small expense. Drips are provided for the removal of excess of water in case of rain, etc. The two baskets above the lights are gracefully supported by tubing, through which the wires are run, and below them is fastened a reflector which serves to distribute the light more evenly and efficiently. The lamps are of 16 c. p. each and are surrounded by an ordinary cut glass or holophane globe. As will be seen, lugs are provided at the upper end of the post for supporting the ladder of the cleaner and the "lamp post gardener." Rings for tethering horses are found near the lower end. In order to increase its usefulness a police and fire alarm box is attached to the post and the wires to it can be run through the post itself. The appearance in the daytime from the street is that of a glass flower basket.

We understand that the company are in the market for fifty posts of this or a similar design, and all communications should be addressed to Mr. Pierre Waggaman, Cleveland Park Land Company, Washington, D. C.

Reduction of the Price of Current by the New York Edison Co.

CONSISTENTLY with its intelligent and well matured policy of lowering the price of current to all consumers as fast as the growth of the business and progressive economies in current production would allow, the Edison Electric Illuminating Co. has now made a further reduction in its regular charges. The new schedule is:

For retail use, 20 cents per kilowatt hour (equivalent to 1 cent per 16 candle power 50 watt incandescent lamp hour, or 10 cents per standard arc lamp hour) for first hour's average daily use of the total lamp equivalent connected; 15 cents (¾ cent or 7½ cents) for the second hour; 10 cents (½ cent or 5 cents) for the third and fourth hours; and 5 cents (¼ cent or 2½ cents) for all use above four hours.

For wholesale use, with a guarantee of 2,000 kilowatt hours consumption each month and two hours average daily use of installation, 10 cents per kilowatt hour for the first four hours average daily use and 5 cents for all use above four hours; or, at the option of the consumer, the present wholesale or kilowatt rate of 10, 9, 8 and 7 cents per kilowatt hour for 2, 4, 6 and 8 hours average daily use, with reductions for quantity, etc.

These prices cover both incandescent and arc lighting, and include renewal of incandescent lamps (not exceeding one 16 c. p. lamp for each 20 kilowatt hours), and the carbons and trimmings for arc lamps, but not first supply of lamps. The company, however, in accordance with general practice, waives for the present the last condition, and continues, until further notice, the first supply of incandescent lamps.

All prices are net cash, but on the new schedules, 5 per cent. on bills of $500, and 10 per cent. on bills of $1,000 in one month, will be allowed on the net bill for payment within ten days after presentation of bill.

Household elevators, pumps, etc., may be included at the retail rate without separate metering or separate minimum charge. To encourage cooking, heating, etc., by electricity, household apparatus for cooking, heating and ventilating, will until further notice be excluded in reckoning installation. Thus the cost of lighting will be relatively diminished by the use of current for these purposes.

These prices will be made for the period October-December, 1898, with the intention, should results justify, of making them permanent, and possibly of still further reducing rates for long-hour use or making a maximum rate equivalent to ¾ cent per 16 c. p. incandescent lamp hour. Contracts will be made at the above prices, however, for a full year. Plans to reduce rates for power service are under consideration.

Mr. R. R. Bowker, first vice-president of the Edison Company, in answer to inquiries as to the purpose and effect of the company's new rates, said that for three or four years past careful studies of the methods of charging for electric current had been made by himself and by the staff of the company, abroad as well as in this country. The Edison Companies in the larger cities had been in constant consultation on this subject, and it had been thoroughly discussed at the conferences held by the Edison Association at Sault Ste. Marie a few weeks ago, and at Niagara last year. There was general agreement that it was wise business policy to make very low rates for long-hour use of electric current. Hitherto many consumers of electric light, particularly residence customers and shopkeepers, had used electric light only in a limited way and for show purposes, while using gas for those portions of a house or shop where light was required for many hours of the night or in the daytime.

When asked whether the reduction was made in view of competition with other electric light companies or of the ru-

Digitized by Google

mored supply of current for lighting from railway plants, Mr. Bowker stated that the business policy of the Edison Company had been determined without reference to outside competition. The present reduction was authorized by the directors early in the year, and was but one of several reductions which had been successively made in the same direction. It was believed that the new rates would be in the interest of all electric lighting companies in the city. Before applying them on the proposed large scale to the Edison business, similar rates had been experimentally applied on the Harlem Company,-a company using alternating current, but associated in management with the Edison Company, in whose field there was practically no competition from rival companies. The result of eight months' experiment had been so satisfactory as to prove that for small as well as for large companies the reduced rates promoted business to a very large extent and definitely increased revenue. The Edison Company expected some reduction in revenue at the start of the new rates, but a considerable increase of revenue when these new rates had had their effect in increasing the long-hour use of electricity. As the Edison Company makes a practice of giving to all existing customers the benefit of any rates offered for new business, the new rates will be operative in all its business at once. It was probable that the rival electric lighting companies would adopt equivalent or similar rates.

If the railway interests should obtain legislation enabling them to sell electric current for lighting purposes, they would confront the same problems which are before the electric lighting companies, since the maximum demand for electricity for traction purposes, especially in New York, occurs when the demand for electric light and power is greatest. This is in the late afternoon when the office buildings are lighted up and residences are being lighted, and before the factories have shut off their supply of electrical power—the same hour at which the business population is beginning to crowd uptown. The Edison Company, although it has associated with its management the Manhattan and Harlem Companies, has never sought to do away with competition in New York, and its large installation, aggregating now in lighting and power the equivalent of over 800,000 16 c. p. lamps, makes it able to hold its own with any form of competition within sight.

In relation to the effect upon gas companies, Mr. Bowker said that the normal increase of the gas business had been so large in the growth of our great cities that they had probably never seriously felt the competition from electricity supply. The improved methods of gas burning, giving more light from less gas, may have reduced consumption and revenue for lighting purposes, but the increasing use of gas for fuel probably more than compensates. Electricity is coming more into use for heating and cooking purposes, because of its convenience, but it is still a luxury in these respects, whereas gas is proving both cheap and convenient for such use in all classes of homes. Mr. Edison long ago pointed out that in the long run electricity would have a certain advantage over gas, because as electricity supply increased the fixed charges would be lessened per unit of output, while to the extent that it had influence in curtailing gas supply it would tend to increase the fixed charges per thousand feet of gas. The first part of the prophecy has been fulfilled, as electricity is to-day produced and sold much cheaper than in earlier years; but the enormous growth of population has so far prevented, and may for a long while to come prevent any serious decrease in the gas business.

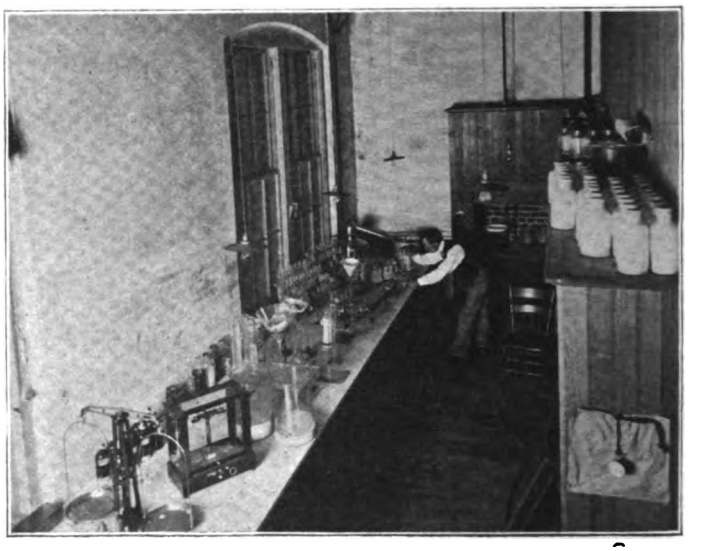
Incandescent Lamps as Manufactured by the Shelby Electric Company, Shelby, O.

THE "Shelby" lamp has brought the name of the Shelby Electric Company, by which it is made, into great prominence, because it has sustained to a reasonable degree the claims made for it. Although the first lamp made by this company was only put on the market in March, 1897, the demand has continually been beyond the capacity of the works, necessitating the enlargement from time to time, until they are now turning out in the neighborhood of 5,000 lamps daily, and another enlargement of the works is contemplated in the near future. The product includes lamps for 250-volt circuits of 8, 16, 32, and 50 c. p., and lamps of every candle power between 4 and 50 in every voltage from 40 to 250 volts.

One of the special features of the "Shelby" lamp is the shape of the stem which supports the filament within the globe. This stem, in the "Shelby" lamp is made U-shaped by a pair of small glass tubes joined at the base by a glass bar. By this means the terminals of the filaments are so supported and separated that they cannot short circuit. Moisture cannot find its way into the stem because of the peculiar manner of joining the stem to the base of the bulb. Other advantages are evident, as the leading-in wires are insulated and the loss caused by what is known as "the Edison effect" is entirely prevented. Other claims made for the lamp by the manufacturers, include regularity of product, extremely long life at stated efficiencies and uniform maintenance of candle power throughout the life of the lamp. These lamps are made with tipless bulbs, consequently no shadows are cast. There is no tip to be broken off, and the bulb, being left in its original shape, is stronger.

The principal features of merit lie in the filament, which is made in a manner radically different from that ordinarily followed in the high degree of vacuum obtained by special exhausting apparatus used only by this company.

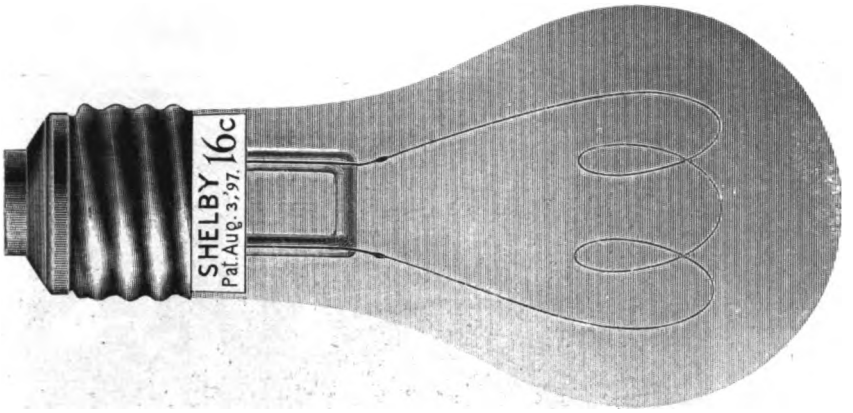
In following the manufacture of these lamps in detail we first go to the chemical laboratory shown, where the filaments are made. Here the chemicals of each kind are tested in a manner that satisfies the chemists that each particular lot is of the same

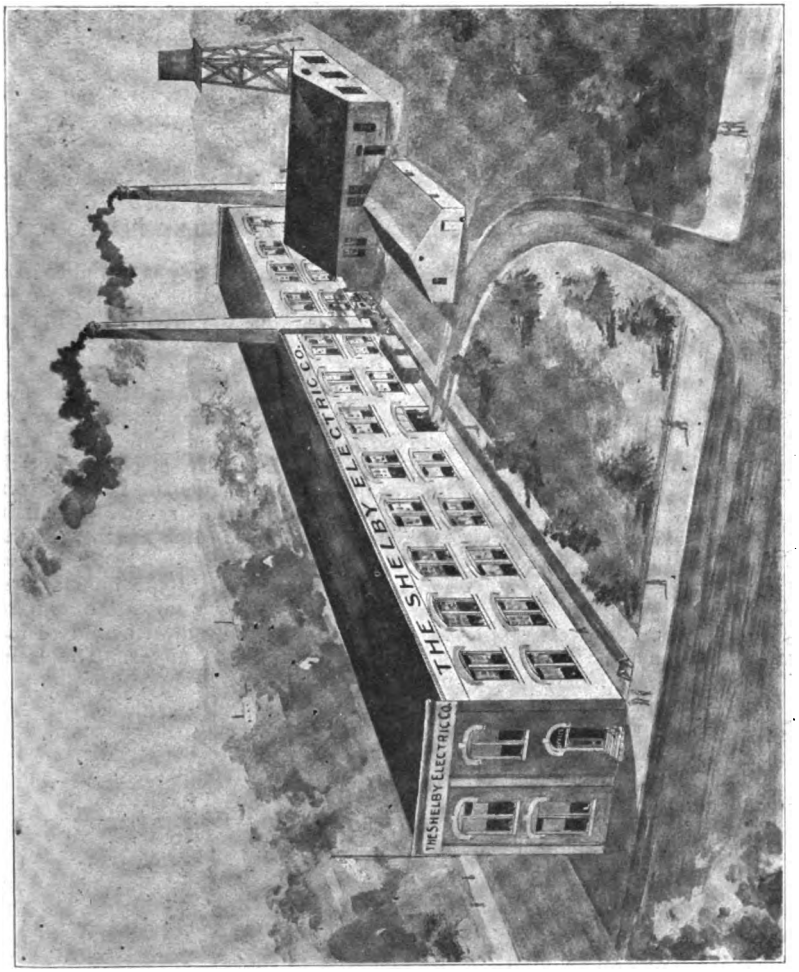


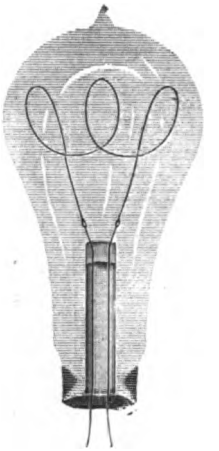
ONE END OF CHEMICAL LABORATORY, SHELBY ELECTRIC COMPANY.

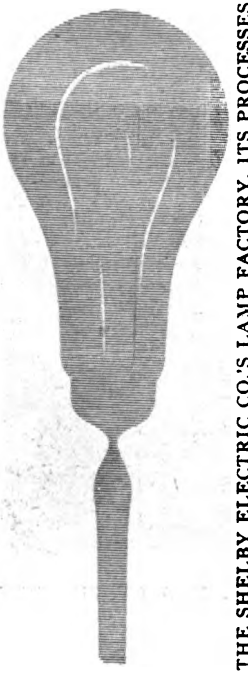
strength and purity as the standard from which the formula was made. The material from which the filaments are made is a secret with the company and is carefully guarded. After the filament is made into threads or strips the next step is the shaping and carbonizing process. For this purpose the filaments in lots of fifty are carefully placed on carbon forms, so shaped that the filaments are readily coiled about one portion, making three wraps, which results in three loops in the filament. This is a special feature of the "Shelby" lamps, the advantage being that the filaments will not droop and touch the bulb, regardless of the position in which they are used, and that vibration does not injure them and no anchor is necessary. The coils being in place on the form, the ends are fastened by means of paraffine, when the forms with their contents are packed in crucibles with pulverized graphite. The crucibles are then covered and sealed and placed in special furnaces, where the temperature is gradually raised by even stages until a certain very high degree is reached, and it is then cooled by the same gradual process until the crucibles can be taken out. When the filaments which have by this process become carbon are removed from the crucibles they have the appearance of a fine steel wire, the loops maintaining their form. The filaments are now assorted in four or five different grades by means of micrometers which measure to 1-3,000 of an inch. They are trimmed to accurate lengths and made ready for attachment to the platinum wires. The platinum wires have been prepared from carefully selected platinum, which is first cut into short sections. The ends of these platinum tips are then flattened and drawn by means of pliers through a ruby die which forms a little tube of the flattened end. The opposite end is then fused to silvered wire, which ultimately forms the leading-in wires to the lamp. The ordinary lamps on

Digitized by Google

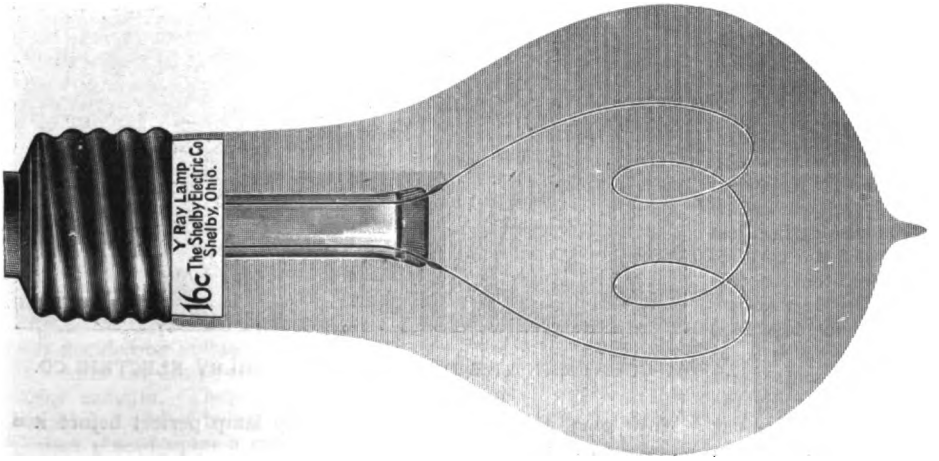


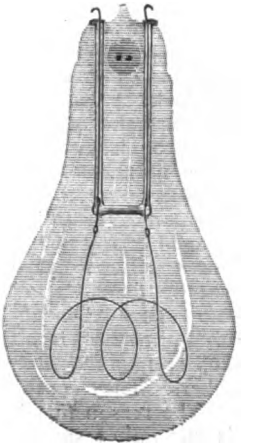






THE SHELBY ELECTRIC CO.'S LAMP FACTORY, ITS PROCESSES AND PRODUCTS.



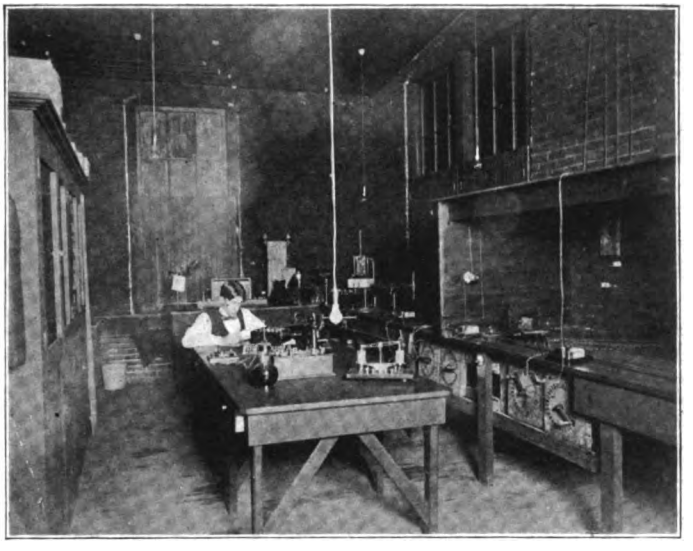


Digitized by Google

the market are made with copper wire in this part, but as oxidixation and rust are likely to occur, the Shelby Electric Company, at an increased expense, have adopted the plated wire.

These wires then go to the stem room, where they are attached to the U-shaped stems above referred to, the glass bar being fused tightly around the platinum tips so that no leakage can possibly occur. These stems, with platinum tips and leading-in wires, are then taken to the mounting room, where the filaments are mounted, by having the ends inserted into the little tubes on the ends of the platinum wire. These tubes are then pressed firmly against the filament by means of pliers and the stem with filament attached is then taken to the connecting room, where the welding or plating of these contacts is performed. For this purpose a specially designed machine is operated, into which the terminals are carefully clamped and a current controlled by an automatic regulating device is directed through the section, welding or depositing the plating product. This makes a perfect contact between the filament and the platinum wires. For this operation a small generator is provided and there is a very curious current regulator which controls the current by steps until the contact is perfectly formed.

The filament and stem is then taken to the treating room, where it is subjected to a plating process, which makes it uniform in resistance throughout its entire length. This process consists in placing the filaments, a number at a time, within receivers, where they are lighted in a vacuum and the filament is burned for a while in carbon gas. Auxiliary equipment for this

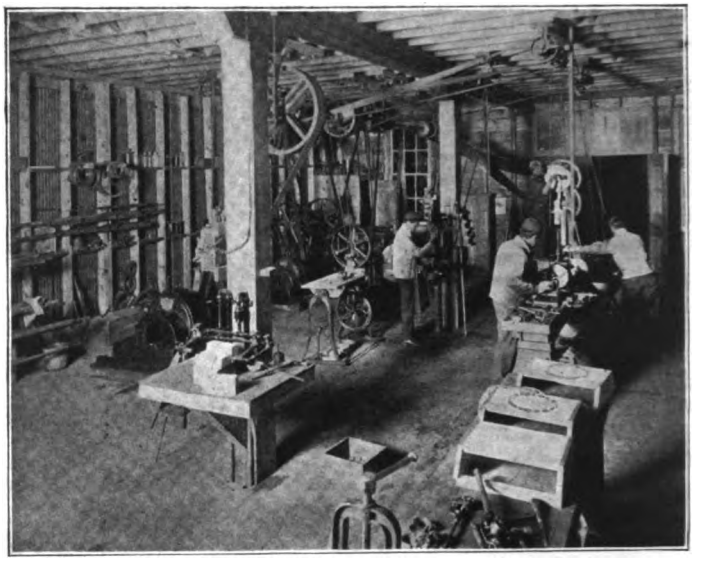


ONE END OF PHYSICAL LABORATORY, SHELBY ELECTRIC COMPANY.

process consists of a large number of resistance coils which are attached to the side rooms near the instruments and a number of delicate instruments by which the current is measured and regulated. In this process the current is automatically turned on, and when the proper condition is secured it is cut off and thrown to the next carbon. The instruments for this process have all been designed by the experts of the company and are very efficient in their operations. In connection with this treating process are three switches and gauges which register units, tens, hundreds and other appliances of like nature for different stages of the work.

Each particular bake of filaments has selected from it fifty, which are run through the above process before the bake (which contains in the neighborhood of 5,000 filaments) is accepted. These fifty filaments are then made into lamps and are tested by what is known as a forced life test to show that the carbon has not been damaged in any of the operations and that the carbonization has been perfect. After having been submitted to this very rigid test the filaments are accepted and continue through the same course, and when all have been treated as described they are ready to be sealed into the glass bulbs.

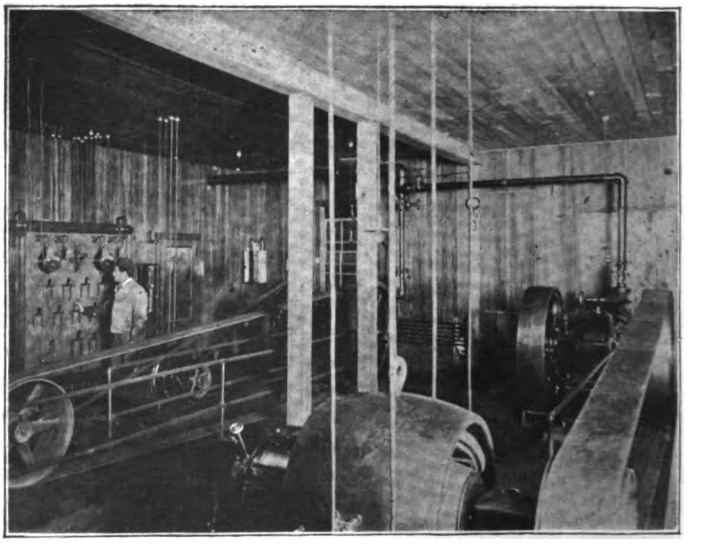
These bulbs are purchased by all lamp manufacturers from the glass makers. They come to all of them in practically the same shape. The reason that lamp factories cannot make their own bulbs is that only a small portion of the glass in a pot can be used for this purpose on account of transparency. The rest of the glass would be dross unless it could be made into dishes,



A CORNER IN THE MACHINE SHOP, SHELBY ELECTRIC CO.

bottles and other glassware where transparency is not necessary, consequently a lamp factory would have to be prepared to dispose of a large quantity of glassware for the privilege of making its own bulbs.

We show by illustration the form of the bulb as it comes from the factory. When it reaches the lampmaker it is carefully washed and dried by means of rapid circulation of air to prevent the leaving of spots on the bulb. It is then "tubulated," ordinarily from the top, as is shown in the figure, page 359, but the Shelby Electric Co. reverse the order of things and tabulate from the bottom, as shown in the figure. By this reversal of affairs many advantages are claimed. There are some advantages that are considered too evident to allow of argument. In the process of fusing the stem containing the filament to the bulb a large number of operators are engaged and each operation requires the greatest care and skill, as every opening must be closed in a manner which absolutely prevents leakage of air. The stems must be absolutely straight in the bulb and dropped into the bulb to an exact point, as nothing gives such a bad impression as to receive a lot of lamps with stems on one side, one carbon low in the lamp and one high. Regularity adds to the attractiveness of any product, and these operators, who are paid on the piece-



CORNER IN THE ENGINE ROOM, SHELBY ELECTRIC CO.

work plan, are obliged to make every lamp perfect before it is accepted from them.

Digitized by Google

After the stem is sealed into the lamp dents or cavities are formed in the neck which provide holds for the plaster which attaches the base to the lamp. Before the lamps are based they are attached by the tubes, to which attention has already been called, to forks. These forks each have twelve prongs. To each one of these prongs a lamp is attached. The forks are then placed on the exhausting apparatus. As soon as the air is exhausted from the lamps the lamps are lighted, first by a weak current, which is gradually increased, and as the lamps continue to burn the product of combustion is pumped out, a process which requires about one hour and three-quarters. As the process goes on hoods are placed over each lamp, which retain the heat generated by the burning, so that the temperature of the bulb is raised, and they assist in vaporizing the air and the gas within, which have a tendency to adhere to the inner walls of the globe. By this and other means which are employed specially by this firm a very high vacuum is obtained, which, as before noted, adds materially to the life of the lamp.

The lamps are removed from the forks by means of portable blow pipes which fuse the tubes and cause them to collapse, hermetically sealing the bulb. The bulbs are then removed and the tip of the bulb further reduced by a second heating process.

The lamps are now tested in a dark room for vacuum by placing the terminals on an induction coil of high potential, which causes the bulb to emit a peculiar glow, showing the condition or degree of the vacuum. Should the glow not prove that the vacuum is a "dead black," the lamps are returned to be re-exhausted.

We next follow the lamps to the photometric room—the usual dark apartments, in which especially designed instruments are employed for measuring the lamps, showing the candle power, the current in volts, amperes and watts. The photometric instruments consist essentially of Y-shaped tubes about 10 inches square and 8 feet in length, with a standard lamp for comparison. In the process one attendant attaches the lamp to be measured to a swinging arm by means of which it is introduced through a small door into the tube, when the current is turned on and raised or lowered until the light is exactly the same as the light given by the standard. At this point the voltage and current are read by a second operator and recorded on the lamp by the first operator.

The standard lamps are made by the company in their physical laboratory. In this laboratory is every known instrument that could possibly be used to advantage in the manufacture of lamps —reflecting photometers, bridges of numerous shapes and designs, induction coils of several sizes, standard ohms and standardized standards of candle powers, such as are used in England and Germany; three different types of photometers, one of particular interest, which changes the light to any color in order to detect more readily any difference in the quality; spectroscopes for discovering the presence of any mineral impurities, and, in fact, instruments for every purpose.

The standards used in the photometer rooms are made in the laboratory and are checked up hourly, so that any change would be at once detected. The photometer rooms are operated by a large storage battery, and the most perfect measurements may be taken by the skilled operator at the rate of about 2,500 per day in each room.

From the photometer room the lamps go to the selecting room, where they are selected and placed in trays, each lamp going into any tray being the same in voltage and amperage as the other lamps upon that tray. The trays, when full, are taken to bins which contain lamps of corresponding voltage and current. In these bins the lamps are left until the order is received for them.

The stock house of the company is separate from the main building, connected by a bridge, which in case of fire can be immediately removed. This stock room contains 600 bins, used solely for the storing of lamps. The bins contain about 1,000 lamps each.

By means of a card index a running account is kept with each bin in the stock room, and when an order is received, after having been entered on the book, a shop order is made out and this order states from which bin the lamps are to be selected. This is decided by voltage, candle power and current ordered.

After the lamps are selected on the order they are tested again for vacuum. They are then based with the proper base and soldered. After being soldered they are permitted to dry and are then placed upon a rack and burned for one hour before shipping, and while being burned undergo their final inspection as to appearance when being lighted with the current required and as to the workmanship and material used throughout.

After this test the lamps are taken to the shipping room, washed and carefully wiped and dried. They are then packed in pasteboard boxes having partitions for receiving twelve bulbs. These boxes are then packed in substantial wooden cases, the cases being manufactured in the wood department of the factory.

The power equipment of the works occupies a separate building in which there are two 80 h. p. automatic cut-off high-speed engines, which drive, by means of countershaft, three generators which give the different currents required. They also drive the vacuum pumps and air compressors. Steam is generated in two large return tubular boilers.

Adjoining the power house is a small station, with another engine for operating the gas making machinery. Near this is an underground tank with sufficient capacity to hold a large amount of gasoline, which is vaporized, forming the gas for the glass-blowing and soldering instruments.

Adjoining the engine room is the machine shop equipped with all the necessary tools for the working of iron and brass, to manufacture the special instruments and appliances used about the works. The tools are operated from two Card motors and the vacuum pumps are also operated in this way.

The works occupy a substantial brick building, located on the edge of the city. The structure is two stories in height, with basement, and the ground dimensions, exclusive of power plant, are 200x64 feet. The employees number about 180, and are, many of them, girls who have been employed in other factories, but a large number of girls from the neighboring towns and vicinity have learned to perform this very particular work and are making fairly good wages. The pay of the girls averages about $1.35 a day.

Every step in the manufacture of incandescent lamps requires great skill in the mechanical details, and supervision, and one of the most expensive parts is the inspection and superintendence of the work. This one feature permits parties who do not pay the proper attention to it to undersell those who do, but the general class of lamp users and buyers demand the highest grade article they can obtain, and consequently the factories that pay well for inspection have been enabled to secure large trade. while those who do not pay attention to these details have not been able to reach any large capacity.

The vacuum rooms and testing rooms of this plant have a very attractive appearance when a large number of lamps are burning at one time, but the heat is naturally excessive. The chemical and physical laboratories are extremely interesting to any one who has any knowledge of these matters.

The offices of the company occupy a portion of the ground floor in the west end of the building, and are nicely partitioned off and furnished with all the necessary appliances for the convenience of the office force. A private telephone system is operated which puts each of the offices in direct communication with the heads of any of the departments throughout the entire plant. Card index systems are used by which a full and complete record is kept of every order and inquiry that is received, and the entire equipment of the works is up to date, and the atmosphere is permeated with the spirit of progress. The technical department is composed of experts who have had extensive experience in the various lamp factories of this country and in Europe, and no expense is spared to make the product of the company what they advertise it—"the best on earth."

PERSONAL

MR. J. W. McDONOUGH, for whom the invention of the telephone was once claimed, now has the posthumous credit bestowed on him by some of the newspapers of discovering the secret of practical color photography.

PURDUE UNIVERSITY, Lafayette, Ind., has just issued in neat pamphlet form, with many illustrations, Mr. Samuel Insull's address on "The Development of the Central Station," delivered before the students in the engineering departments, and given very fully at the time in the pages of The Electrical Engineer. The record and discussion embodied in this lecture make the pamphlet one of the things to preserve.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 9, 1888.]

Vol. XXVI. NEW YORK, OCTOBER 13, 1898. No. 545.

The Lowering Price of Current.

A NEW schedule of prices for current has just been announced by the Edison Electric Illuminating Co. of New York, and is given on another page, with some striking comments by Mr. R. R. Bowker, vice-president of the company. Rarely has the appearance of a price list been accompanied by so much comment, and the indications are such on every hand as to suggest that the new rates will be a memorable point of departure. As a matter of fact, to which our columns bear testimony, the Edison rates have been steadily and systematically reduced for years, and this is but one step. The reduction is not aimed at gas, as some of the newspapers assume, nor is it a protective measure against new competition, as other newspapers assert, but its bearing upon both aspects of the present situation in New York is very significant, and we do not remember any period in the last ten years when such an interesting state of affairs has demanded study.

First of all, we have the new Edison prices. Then we have the organization of a mysterious new company with a capital stock of $25,000,000, to control light, heat and power in this vicinity. Then it is said that ex-Governor Flower and some friends are planning a consolidation of lighting, railway and gas interests in the Hudson River cities. Finally, it is asserted that the Metropolitan Street Railway Co. intends to go into the lighting business. Where there is smoke, there is fire, and it is certain that some definite truth underlies all this gossip. Several weeks ago, before a paper in the city had noted it, we referred to the Flower rumors; and nothing has occurred in the meantime to change the outlook. As to the Metropolitan Company, it has been common gossip in electrical circles for months that the newer conduits were far beyond actual necessities, and had in some instances already been filled with cable that could only be used for lighting purposes.

It is assumed by "The Evening Post" in a remarkably shrewd and well informed article appearing last week, that the lighting, railway and gas interests in the Greater Manhattan are coming together because there are cogent reasons for it. Although the argument seems to us to be over-emphasized in one or two places, it is in the main very sound and forcible; and that journal takes it for granted that the impending deals are based upon the facts it sets forth. Not only is it asserted that the new Edison prices tend to diminish gas consumption to a marked degree, but it is insisted that in turn the lighting companies are not able to generate current as cheaply as the electric railway companies can. Hence they must all "come together." Now there can be no question that with large plants running almost every hour of the day under heavy load, the trolley roads have reached a point of very low economic production, but we are by no means sure that the Metropolitan Co., for example, can "produce" any better than the New York Edison Company can, for their generators are much of a size, and their hours of supply are after all much the same, especially when we count in the storage battery.

The main point, however, if it be a question of competition, is that if a new company buying spare or surplus current from the Metropolitan should essay to do lighting, there would still be, as suggested by Mr. Bowker, the "peak of the load." Now the traffic peak at night comes just when the lighting peak comes; and a plant designed to cope with the job of overcoming both peaks at once would need a very expensive margin of spare apparatus or a very big storage battery. No doubt a harmonious combination of the various systems under one management could deal with these points, not the least of which would be that of hitting upon some way to generate only one kind of current. Just at present, we have direct current, alternating current and phase current in New York City, and the voltages range from the 2,000 arc and the 500 railway down to the 220 and 110 incandescent. Unless these are put on a basis of working uniformity of origin no desire to utilize "surplus" current can be carried out in the financial line with any profit to the promoters or to ultimate investors. This initial operation may prove expensive, but would be a good thing for the manufacturing companies supplying the apparatus.

The Charging of Secondary Cells.

ONE of the most timely papers read at the recent B. A. meeting and one which evoked considerable discussion on the other side of the Atlantic, was entitled "A Comparison Between Charging a Secondary Cell at Constant Potential and at Constant Current, More Especially as Regards Efficiency," by A. A. Cahen and J. M. Donaldson. The importance of the carefully made tests presented by the authors must be admitted when one considers the growing importance of the storage cell, the willingness of the electrical engineer to install it on a larger scale if well known obstacles can be overcome, and the knowledge, in the past, that storage batteries can be charged at a constant p. d. with a great saving of time. However, accurate tests have never been made, to our knowledge, to determine how this advantage may be offset by losses in other directions, and, as the authors state, in order to get a fair estimate as to relative merits of the systems the following items have to be considered: 1. The discharge capacity or the energy that can be got out of the cell. 2. The time needed for charging. 3. The storage efficiency, ratio between watt hours taken from and those given to cell. 4. The constantcy of the p. d. during discharge. 5. The life of the cell. After making an extensive series of tests the authors find with reference to the first three, that by charging at constant p. d. the time of charging is less than half that required at constant current. The capacity obtained in a constant p. d. charge is about 30 per cent. greater, the energy efficiency being, however, 10 per cent. less than that from a constant current charge. This loss in efficiency, the authors believe to be due to the excessive heating caused by the large initial charging currents. Regarding the fourth consideration, it was found that the discharge after a constant p. d. charge takes place at a much steadier p. d. than is the case in a discharge after a constant current charge. Finally, with regard to the life of the cell, no definite conclusions can be drawn from these tests, as no long-life experiments were made. The longest test made at constant p. d. included fifty charges, which did not noticeably injure the cell.

One of the most interesting and valuable results obtained was the discovery of the fact that the capacity of the cell was considerably increased when charged at a constant p.d., as stated above. This may be due to the fact that the p. d., being as high, namely 2.5 volts, at the beginning as it ordinarily is at the end of the charge, allows the action to penetrate more deeply into the substances of the plates. It may be asked why the authors chose a voltage of 2.5 and not a higher one, and note the effect. Perhaps they feared too great a heating of the electrolyte and a correspondingly large loss in efficiency.

In fact, the tests which on account of their great accuracy and thoroughness are of inestimable value to the engineer, open up a large and profitable field for investigation and research. The saving of one-half the time required for charging at a loss of only 10 per cent. in efficiency certainly makes one anxious to learn facts regarding the life of the cell under such treatment. Some engineers go as far as to state that rapid charging, within certain limits—which also means more frequent charging—will im-

Digitized by Google

prove the condition of the plates and therefore the life of the cell. One thing is certain, that the gain on the one hand is a loss on the other, and it only remains to determine which is the most profitable course to pursue.

The Prejudice Against Machinery.

MANY disease germs appear to have a tenacious grip on life. It may be queried whether those which attack the body are more persistent than those which attack the mind. Among the latter is the prejudice against new inventions and new machines. We are not surprised to find a Chinaman uprooting telegraph lines or smashing locomotives, but the idea that modern civilization has cured Western peoples of such a tendency is founded upon fallacy. A curious instance of the survival of such an invincible opposition to the human advance embodied in the perfection of machinery for lessening manual labor has just been presented under novel aspects in the bicycle field and in opposition to the reduction of pedal labor. One of the features of bicycle racing is the use of pacemakers to get the best speed out of the contestants, and thus a regular pacemaking industry has sprung up. It has, however, long been apparent that there were possibilities for machinery in this field, and hence a number of mechanical pacemakers have been tried. The subjoined incident, occurring in the vicinity of New York, would go to show that an electrical contrivance is getting pretty near the mark of success: "The owners of the machine trembled in their shoes as they listened to this abuse, with not a word to say, for fear that they also would be maltreated. Some of the men pulled out pocket knives; others had pins, and ere anything could be done the tires of the fatal machine were turned into a sieve. The men had mounted and were just ready to start off for an exhibition. Charlie Murphy, once famous in cycling, was riding the rear seat and manipulating the switchboard, turning on and off the electricity to make the machine go. When the word came to go, it was noticed that the tires were deflated, and upon examination found to be literally cut to pieces. Murphy jumped from the rear seat, white as a sheet, forgetting to turn off the current. The 1,100 pound machine fell heavily on its side Kluge being unable to hold it up alone, with the rear wheel revolving at the rate of a mile a minute. The batteries were broken and all the fluid spilled on the track. The pacemakers were in a delightful frame of mind at the mischief they had accomplished."

Possibly these vandalistic pacemakers think their Oriental aim is accomplished, but they are sadly mistaken, if the apparatus should prove to have real merit. But one cannot help being both amused and startled at the attitude of these men, who represent that which is itself one of the most innovating and revolutionizing machines the world has seen. Barely yet, even in the countries where it is most popular, has the wheel established itself permanently, with due recognition of its rights to existence. But these ignorant sports, at one small end of the bicycle industry, assume to own the universe and give themselves airs that a Thibetan conservative might envy. Some day or other we may take it for granted the Bourbons of the horseless age will be objecting to progress, and the hackmen who drive motorcycles will be pounding the life out of unfortunate æronauts who shamelessly avoid hiring cabs by using their wings in preference.

Everybody an Office Holder.

THERE is a lively discussion afoot in Atlanta, Ga., as to spending money on a municipal electric light plant, and lots of clever letters, interviews, speeches, etc., are finding their way into print, pro and con. An article by Mr. James T. White, in the Atlanta "Journal," against the scheme, has just reached us, and we mention it for the reason that it gives some data none of us can afford to overlook. According to Mr. White, there are now on the books of the tax collector in Atlanta, not a large city, by any means, no fewer than about 1,200 office holders and governmental employees, national, State, county and municipal. That is a heavy percentage, and yet the advocates of municipal ownership seek to increase it. What would be the result? "Spain to-day is divided into two classes, the office holders and the poverty-stricken taxpayers; one in luxury, the other in want."

Mr. White says that the real estate business of Atlanta is shown by the tax rolls to be largely in the hands of the sheriff and the city marshal, because of the burden of taxation. Yet it is proposed to spend $150,000 of taxes to create a municipal electric light plant, although a well conducted private enterprise already occupies the ground. Is this reasonable or judicious? And just where such folly stops, no one knows. Mayor Van Wyck, of New York, has lately signified his approval of plans for spending city money in the same way in providing baths for 10,000 or 15,000 people at Coney Island. The next step ought to be the provision of merry-go-rounds and hot frankfurters, which are much preferred to baths by a large proportion of the visitors. This "municipal ownership" business is all of a piece and is a huge folly that will end in a general municipal bankruptcy if it is not checked.

Electrical Refrigeration.

IN the ordinary course of events, a few motors, more or less, added to the load of a central station, are not a matter of general interest or of grave importance. But when a new industry or a general branch of novel application is suggested, which if exploited might mean a great many motors in a great many places, then the public in general and the central station manager in particular have something submitted for consideration which they cannot very well neglect. It is because of the radical, basic nature of the electrical refrigerating system now being described in our columns by Mr. T. J. Fay that we deem it proper to call special attention to these articles. In modern commercial and industrial life, refrigeration plays a large and growing part, and the ability of electricity to meet the conditions are admirably brought out by Mr. Fay. The public is wishful of getting more refrigeration, in homes and offices as well as in stores and breweries. The central station manager who is worth his salt keeps a keen eye on everything that will benefit his load factor. To both, Mr. Fay addresses himself, and the ingenuity of the plan unfolded in the text is made clearer by the excellent and numerous diagrams. There, without doubt, lie the elements of another electrical art.

HILFSBUCH FUER DIE ELEKTROTECHNIK. By C. Grawinkel and K. Strecker. Fifth Edition, Enlarged. Berlin. Julius Springer, 1898. 361 illustrations. 696 pages. Flexible covers, 5x8 inches. Price $2.00.

This excellent office reference book has been thoroughly revised and enlarged, bringing it well up to date. The part relating to dynamo machines especially has been subjected to a thorough overhauling and, together with the tables on transformers, no less than 129 different types of construction are illustrated by new diagrams. Other parts have been similarly looked after. There is scarcely a problem confronting the electrical engineer or electrician on which the book does not give data with more or less fullness.

ELEKTRISCHE LICHT-UND KRAFT-ANLAGEN. (Electric Light and Power Installations.) By Dr. Ludwig Fischer. Wiesbaden, 1898. C. W. Kreidel. 317 pages, 7x10 inches. 165 illustrations. Price, $2.50.

This work gives a very good description of the various points which have to be kept in view in the installation of electric light and power plants for all purposes. It is not so much intended for the practical electrical engineer as it is for the student and for those engaged in other engineering branches who desire to acquaint themselves with the problems involved in such work. The book includes not only electric light and stationary power applications, but street railway plants as well, together with a number of miscellaneous types of installations. The work has evidently been done with great care and the illustrations throughout ought to prove very helpful to the reader.

PITTSBURG. Mr. Eugene Ingold, inspector of wires, estimates that at least 250,000 incandescent lamps will be used for displays, etc., during the conclave of the Knights Templars. An enormous amount of special and extra wiring is being applied for and the price has gone up briskly.

Digitized by Google

MUNICIPAL AFFAIRS

Some Views and Data on Municipal Ownership.—I.

By HENRY HOPKINS, Supt. Street Lighting, New Haven, Conn.

COME let us reason together. These words, which were uttered so many years ago, are especially appropriate in this age, when there is so much agitation of various sorts of all kinds of ideas. Agitators may be divided into three classes. First, the sincere agitator, whose sole purpose is the betterment of man. Him all the world will keep in mind and honor and respect. Secondly, the apparently sincere agitator, who agitates for motive of revenge for some supposed wrong done him, a wrong which in nearly all cases is a delusion. Thirdly, the political agitator who bobs up just prior to election as the man who, if elected, will give all the people just what they want, according to each individual's idea. And with his defeat disappears the desire to benefit man, until the time comes to nominate again, when he again appears as the would-be reformer who never reforms except in talk for political capital and for selfish motives.

The question before us is a proper one to discuss and should be looked into in all its minutest details. Care should be taken not to overestimate or underestimate any point. At all times the motive of the parties should be considered who agitate such an important question. Sincere motives should be respected, even though the ideas differ from our own. Questionable motives should be regarded with suspicion until investigation dispels all doubt.

At no time in the history of American municipal government has there been such a demand as now for men of true principle, clear judgment, caution and sound decisions, men who cannot be swerved by popular clamor or stampede methods; men who govern, not for man but for men.

What constitutes a positive need for municipal ownership?

First, when the corporations now rendering service are exorbitant in their charges. Second, when the service is poor and is not cheerfully remedied if complained of. Third, when the corporation is simply run for the benefit of the stockholders and the general purchasing public interests are not considered. Fourth, when the three above conditions exist and continue to exist, when the bulk of capital invested is owned out of town and the dividends are spent away from the place where they are earned, thus injuring those who help create the profit. Fifth, when lower wages are paid to those employed than at other places under the same business conditions.

The above reasons are sufficient in my opinion to warrant a municipal plant. If they do not exist caution and judgment are needed by those in authority so that the mass of the people will not be burdened with a doubtful plant on their hands. The question then arises, why cannot a city run a plant more cheaply than or as cheaply as any corporation? If it is a good thing for them, why cannot the same results be obtained by reversing the ownership?

There are many apparent reasons to the thinking man why this cannot be done. First, we have in this country not yet reached that point in civil service reform where a positive guarantee can be given to a man that as long as he continues to serve his town or city with fidelity, honesty and integrity to the best interest of the service and the taxpayers he will be retained in office. Second, that, though he may be the person who must give an accounting of his ability, he is hampered by those who may be inefficient to do the desired work, and he is helpless to remedy it. "Submit or get out" is the alternative, thereby destroying the hope of success. On account of the above reason most men are unwilling to enter the service of their respective communities, to be turned down after a short time. They seek places with the corporation and stay there, and become money-makers for the stockholders. Because of their so doing the cry goes out, which is tainted with socialism, "We must own the plants." Tell me where the fault lies, if any?

We have an example of this in the largest city in our land in the case of Colonel Waring, who inaugurated and maintained the best street cleaning system in the land, bringing cleanliness out of filth and order out of disorder. Was his honesty, ability or industry ever fairly questioned? No, I think not, for it could not so be. This goes to prove my first reason conclusively, for he had to leave the city employ just when he was most successful.

Milwaukee Electric and the Politicians.

The decision of the Supreme Court of Wisconsin regarding Milwaukee's debt limit is considered by interests identified with Milwaukee Electric to effectually put a stop to all attempts on the part of hostile local politicians to interfere with that company. The politicians have been beaten every time they have made an attempt at the municipal possession of this property. It is also believed that the clamoring of the people of Milwaukee for public school and other improvements will be another incentive to the politicians to stop all questionable expenditures.

TELEPHONY AND TELEGRAPHY

The New Telephone Exchange at Worcester, Mass.

THIS building was built expressly as a telephone exchange office and is equipped with the latest and most improved appliances known to the telephone service, and is certainly a model one in every respect. The building is of the commercial Italian Renaissance style of architecture. The foundation walls are laid in dimension granite. The first story, or what may be considered a high basement, is built of pink granite, the remaining stories of the building are of Perth Amboy fireproof brick, of ordinary shape, the trimmings being of pink granite, while above the second story a massive belt course in granite extends the entire length of the Norwich street side of the building and across the Mechanic street front. On the Norwich street side in raised

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY'S EXCHANGE, WORCESTER, MASS.

letters with polished surface is the inscription "N. E. Telephone & Telegraph Co." Across the Mechanic street front are the words "Telephone Building," which are also in raised letters on a polished face. A heavy course of granite completes the top, above which is a strongly projecting copper cornice, the east side of the building being a solid wall of brick, designed as a party-wall. The building in its entirety, is of steel construction, with all the columns incased in terra cotta, and in the details of its construction it is as near fireproof as a building can be, the only combustible materials being in the floors, the finish and the furniture. The floors consist first of cement, and above this are

Digitized by Google

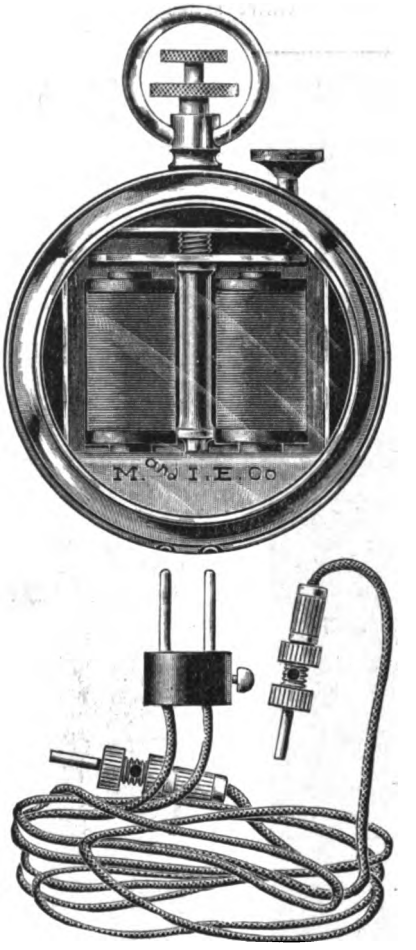
blocks of wood 15 inches square and laid transversely. Excepting in one small apartment the block flooring is red quartered oak and is the first floor of its kind to be laid in Massachusetts, although many noted buildings in England have floors of this kind. The room not having a red oak floor has one laid in quartered beech, making it one of the most beautiful floors imaginable. All of the floors of the building are beyond comparison for solidity and freedom from noise. As the blocks are laid transversely, the general appearance of the floors is that of parquetry work, now so popular in the higher class of buildings. The stairs are all steel, with Hyatt light rises and heavy slate treads. On either side of the Norwich street entrance in mural decoration is a blue bell, with inscriptions, the distinctive sign of the corporation. The first or basement floor is laid in Portland cement, and is divided into various apartments, one of these being the hot water heating plant, consisting of a battery of three boilers of the Thayer improved system. On the first and second floors the heating is by means of pipes placed well above the floor, while the other portions of the building are heated by means of radiators, excepting on the top floor, the telephone room proper, where both pipes and large circular radiators are used. In another apartment on the basement floor is installed the engine, motor, storage batteries and accompanying switchboards, and other pieces of heavy machinery needed. The engine is a 9 h. p. gas engine. Should there be an accident to the engine, the electric motor can be started in a moment by connecting it with the wires of the Worcester Electric Light Company, this motor being installed simply for use in case of emergency, and its installation only shows how complete has been the equipment of the building in its entirety. The whole of the fourth floor will be kept exclusively by the company. This floor is lighted in part by a monitor roof skylight, with copper frame and sash. This immense skylight extends fully two-thirds the depth of the building, and at one end of the skylight is a powerful electric fan that will carry off the heated air of the room; and as this heated air passes away the space is filled with fresh air that enters through ducts. The fresh air enters the room inside the circle made by the radiators, and as it is heated it rises and enters other ducts, whence it is taken by the fan. Hence, there is a continuous supply of fresh air. The switchboard that has been set up in the room is a magnificent affair, and the first one of its kind to be put in operation in the world. The entire finishing of the building, from the basement to the upper floor, is in cypress of uniform color and grain. Each apartment has a wainscot of about 4 feet; above this the walls are tinted. The rooms and halls are provided with gas and electric light fixtures of the most pleasant and attractive design, while all the hardware used throughout the building is pure bronze, designed to match the finish and tints of the interior. Thus it will be seen that the building is one of the most complete and best equipped telephone exchanges in the world.

The Worcester Exchange now has about 1,600 subscribers, and the apparatus is so arranged that three times that number of subscribers' stations could be handled. The switchboard is the first multiple switchboard constructed employing automatic signals. The operator is enabled to complete work of making connection and at the same time the signals are so skilfully arranged that she has knowledge of all connections under her charge. She is not obliged to listen into the line to ascertain if the subscriber has answered his bell or to find out whether he has or has not finished talking, for the lamp signals do this instead. Upon the removal of the telephone from the hook by the subscriber, the lamp is lighted on the switchboard, indicating that the operator must plug into the proper jack. Having plugged into the line, the lamp is extinguished, and, the number wanted having been received, the operator places the second plug of the pair in the jack of the subscriber called for, the lamp then being lighted on the keyboard corresponding to that cord, this lamp remaining lighted until the subscriber called for removes his telephone from the hook. This puts out the lamp and the connection remains until both lamps in this set of cords are lighted again, meaning that both subscribers have hung up their telephones. She then takes down the connection, thus automatically extinguishing the light. The questions to be answered, "Have you finished?" etc., are done away with entirely. In connection with the office there is a generating plant of 60 large-sized cells of storage battery, which supply the current for the lamp signals and are kept charged by dynamos operated by a gas engine or electric motor. The telephone lines from the exchange are underground in the business portion of the city, and come into the building by underground conduits. There are about five miles of underground conduits, carrying nearly 800 miles of insulated copper wire circuit in various cables.

The "Morse-Watch"—A Secret Telegraph Sounder.

THE "Morse-Watch" is a new invention, the product of the Manufacturers' and Inventors' Electric Company, of this city. It is an entirely practical telegraph key and sounder mounted within the popular watchcase known among jewelers as "No. 18 standard size." It is equipped with a soft flexible head band to fasten it to the head over the ear, and a five-foot silk cord to attach it to a telegraph line.

The Morse-Watch, while only of vest-pocket size, has a great



"MORSE-WATCH" SOUNDER.

range of adjustability in sound, working quite loud enough for ordinary desk use in the office, or low enough to be inaudible unless in contact with the ear, and controlling at will all intervening modifications of volume in sound.

It is designed for use in quiet locations, such as private offices of commercial institutions and other places, where the demonstrative telegraph sounder is too noisy or where secrecy of transmission may be desired; and also in very noisy locations where the foreign noises and confusion are apt to drown the click of the ordinary sounder, such as railway stations, public meetings and newspaper offices where the work is transcribed upon typewriters. Thus in quiet places the Morse-Watch does its work silently and in noisy locations, attached to the ear, it defies the effect of noise.

The military telegraph alone is sufficient excuse for the existence of the Morse-Watch. Its secret work can be conducted in the tent without fear of the sound penetrating the canvas walls. At headquarters the eavesdropper hanging around open windows or doors ajar is foiled. Sentinels at inaccessible outposts and lookouts posted in trees can conduct their work, make reports and receive instructions without danger of betraying their presence, doing such work even more silently than it could be done by telephone.

Digitized by Google

The Morse-Watch when mounted with a key is also employed as a pocket or practice instrument, the manufacturers furnishing, when so requested, a neat double cell edition of dry battery in a case of very small dimensions.

Further information can be obtained from the makers, the Manufacturers' and Inventors' Electric Co., 96 and 98 Fulton street, New York City, who issue a comprehensive circular fully describing the apparatus and its uses. Mr. T. J. Smith, president and general manager of the concern, was formerly associated with The E. S. Greeley & Co., and is an old-time telegrapher.

The Victor Express Switchboard.

FOR many years past the necessity for a straight metallic circuit board has been felt by telephone companies, and at last one which gives entire satisfaction appears to have been constructed by the Victor Telephone Manufacturing Company, of Chicago. They have lately developed a new express switchboard, for which many advantages are claimed, some of which are the following: There are no wires running into the jacks; one strong spring serves the purpose of all jack connections; all parts are of stable and simple construction, are durable and can be operated with ease and rapidity.

By adopting as a basis a straight metallic system with double-circuit cords, and with the ringing and listening circuits normally cut out on both sides, an exchange using this board can easily be divided into metallic, common-return or ground circuits, and still have each division separate from the other. This is of great advantage to exchanges that wish to adopt the metallic system and gradually change over the old circuits. Owing to the mechanical construction of the Victor express board, this can be done without any change in the wiring, and as the boards are made up in complete sections, each of five complete drops, jacks and individual ringing keys, any section can be easily and quickly inserted or removed by even an inexperienced person.

In Fig. 1 is shown a front view of five such sections, assembled ready for placing in position in the cabinet. The drops are arranged vertically, beginning at the top, and are numbered in the same manner or in any other way as may be convenient. For numbering, little card or celluloid discs are furnished, which are pressed into recesses made in the front strip. For numbering or lettering trunk or toll-line sections, blank discs are furnished when necessary.

Below the drops are placed the jacks and ringing keys, arranged in the same way. An individual ringing key is provided for each line, so that any subscriber can be called, whether the plug is in the jack or not; or if any two subscribers are connected, either one can be called without ringing back on the other line.

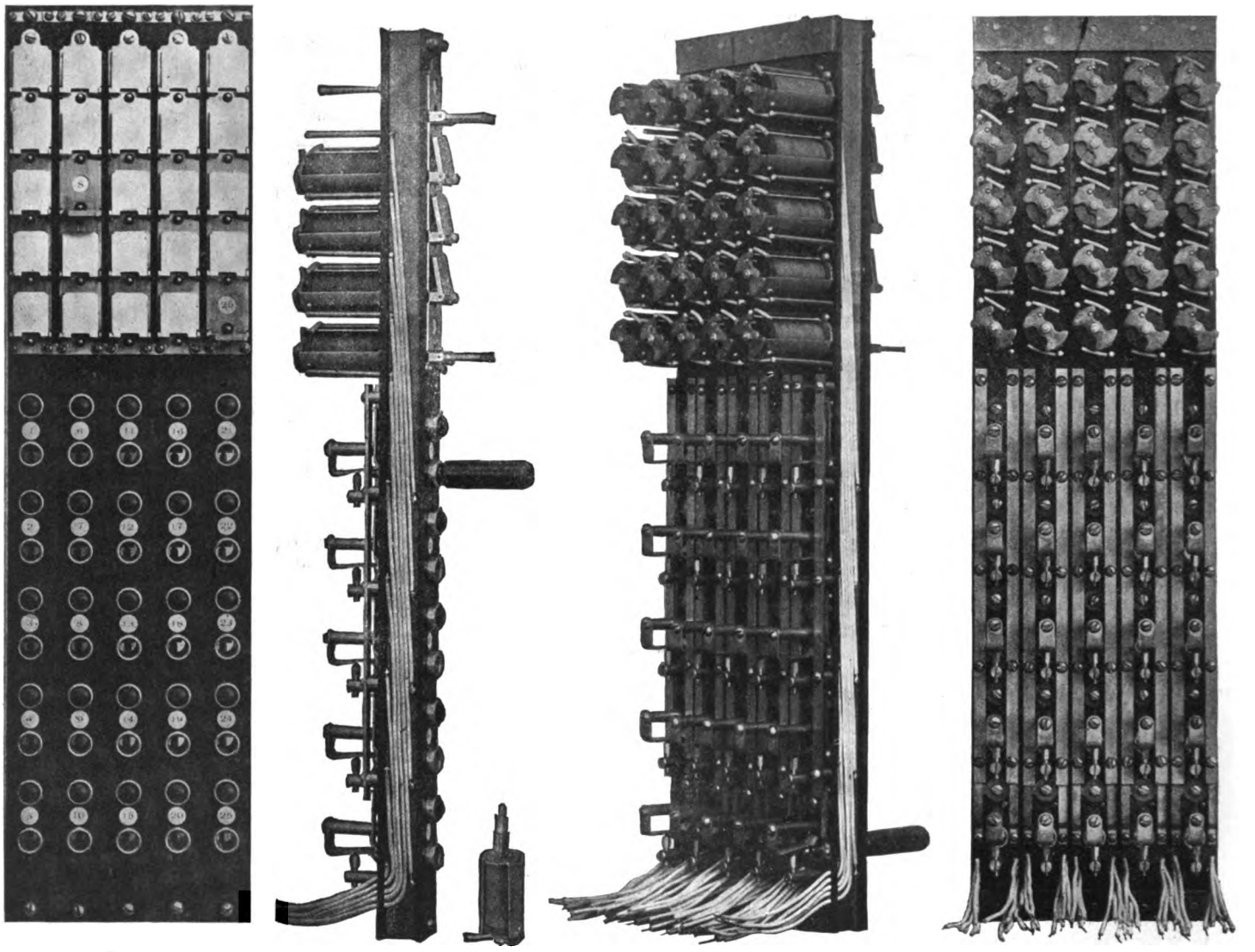


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

VICTOR EXPRESS TELEPHONE SWITCHBOARD.

In the side view (Fig. 2) the arrangement of drops, jacks, keys and coils is very clearly shown, the upper coil being removed, showing the ease with which this can be done, it being merely necessary to rotate the coil one-quarter turn and then withdraw it from the strip.

In Fig. 3 the wiring details and the arrangement of the several parts in general are shown to good advantage. The wiring of each section is complete in itself, all wires being concealed in a vertical groove, so that when the board is connected up no wires

Digitized by Google

either on the front or back are visible. All of the connections are, of course, carefully soldered, and the wires insulated with the best quality of rubber.

Fig. 4 shows the back of the board.

In the construction of the drop magnet several novel features have been employed. It is of the tri-polar type, with the armature placed so as to obtain the highest possible efficiency. The coils are wound in even layers with silk-covered wire, and can be removed without taking out any screws. As the coils are not in series, there is no retardation or counter electromotive force to affect the telephone current. Consequently, to change to a toll-line jack, for very long-distance work, it is only necessary to replace the drop coil with one of higher resistance.

The night-bell connection is made in such a manner that there is no metal connection between the drop coil and the shutter, leaving the coils thoroughly insulated from one another, with no possible chance for leakage of current and consequent cross-talk.

Great economy of operation is claimed for these boards, a large number of which are already in successful operation.

A New Telegraph Line For Cuba.

Captain Brady, of the United States Signal Corps, has been ordered to begin the construction of an overland telegraph line 320 miles in length from Guantanamo, via Santiago de Cuba and Manzanillo. The line is to be used principally for the transmission of the Government dispatches, although commercial messages will be accepted. The present cost of transportation of messages by telegraph from Guantanamo to Santiago is 20 cents a word up to 30 words and 12 cents for each additional word.

Large Output of Bell Telephones.

The American Bell Telephone Company makes another record for large addition to number of instruments in licensees' hands under rental. The September net increase was 19,046, making 136,465 instruments added thus far in 1898, and indicating over 1,100,000 instruments in use at the end of this year. Figures follow for month ended September 20:

	1898.	1897.	1896.	1895.
Gross	31,977	19,198	12,042	18,318
Returned	12,931	7,105	7,030	5,659
Net	19,046	12,093	5,012	12,659
December 21 to September 20:				
Gross	244,724	162,743	148,395	128,223
Returned	108,259	69,106	68,547	61,510
Net	136,465	93,637	79,848	66,713
Total outstanding September 20	1,055,586	866,264	754,824	640,383

Speculations Concerning Roentgen Rays.

BY FRANCKE L. WOODWARD.

I READ with much interest the very original article upon the cause of Röntgen rays by Prof. Elihu Thomson in a recent number of The Electrical Engineer, and, as one line of my own research bears closely upon his, a few remarks by me at this time may be fitting.

It has been suggested that if Röntgen rays differ from other forms of radiant energy only in the matter of wave length, the shortness of the vibration period would necessitate a very high temperature for their production. Let me here mention a simple experiment: We have arranged in metallic circuits a telephone receiver, a fine copper wire about No. 30, an incandescent lamp and a Crookes tube. For our sources of electric supply we will imagine a battery of 10,000 cells, with a voltage of about 20,000, such as was designed by Prof. Trowbridge, of Harvard University, and so arranged that the current can be gradually increased to a maximum. Now, upon starting the current through these several circuits, the first effect we note is that of sound given off from the receiver, and as the current is increased the pitch of the sound is directly higher. Increasing the current more, we next notice that the fine copper wire is radiating heat; a further increase will give us the effect of light from the incandescent lamp, and when we have reached a still higher point in the current, Röntgen rays will be projected from the Crookes tube, and apparently with a less production of heat than we noticed in the earlier experiment. In each of the effects obtained we notice that the vibration period is smaller. To give a graphic representation of the displacements and velocities of particles vibrating longitudinally we can conveniently draw the lines which represent those quantities, not in the actual direction in which the motion takes place and which would coincide with a line a, b, c, but at right angles to it, ordinates drawn upward indicating displacements or velocities to the right, and ordinates drawn downward indicating displacements or velocities in the opposite directions. When this is done waves of displacement and velocity are figured identically with those for transversal vibrations, and are therefore subject to the same resulting laws; not only will the above waves enable us to see at a glance the circumstances of the vibratory motion, at the instant of time for which it has been constructed, but also for any subsequent moment. Now, coming to the period of vibration whose effect is recognized as heat. The process of transference from one body to another through an intervening medium is called radiation of heat. The condition of the intervening medium, by virtue of which heat is thus transferred, is called light, and radiant heat is light, but of a vibration period, too long to affect the eye. It is perfectly continuous in quality with the species of radiant heat which we see with the material eye, through its affecting the retina with the sense of light. Thus radiant heat is brought under the undulatory theory of light, which in its time becomes annexed to heat as a magnificent outlying province of the kinetic theory of heat. Light must consist in the motion of particles of some kind from external objects to the eye, or in the propagations of some disturbance or wave motion in a medium. Some of the consequences of the first suppositions are inconsistent with observed facts, and yet the nature of the propagation of the supposed luminous particles is a very interesting study. There is a superior as well as inferior limit to visible rays.

Light, whose period of vibration is too small to produce any impresion upon the optic nerve, can be degraded by fluorescence into visible rays, and can be detected by its energetic chemical action. By proper adjustments, photographs of a region of the solar spectrum beyond the visible red can be obtained. Believing the vibration period of Röntgen rays to be inconceivably short, the idea suggested itself to me that the Röntgen rays should be closely related to those of the solar spectrum, whose period of vibration is very short, the visible rays or black light.

Here I found a most remarkable similarity. The Röntgen rays are invisible to the optic nerve, their vibration period is very short, they can be degraded by fluorescence and cannot be detected by the spectroscope: properties agreeing exactly with these invisible rays of the solar spectrum, and last, the most conclusive and remarkable evidence of their similarity. I have recently been able to obtain very well defined radiographs of the hand and other non-transparent bodies by using these invisible rays of small vibration period, the time of exposure necessary, however, being comparatively long. These spectroscopic X-rays resemble the Röntgen rays precisely, and, like the Röntgen rays, their penetrative property is cut off by glass in the same proportion.

Returning again to the speculation which has been offered to the effect that Röntgen rays require a very high temperature for their production, I do not agree with the statement in the absolute. Of course, we know that Röntgen rays are produced at times, when a very high temperature is evident and one of the electrodes is perhaps in an incandescent glow, but again, they can be produced with a single terminal entering the tube and practically no heat being radiated, depending mainly upon the construction and type of tube used.

Tracing the vibration periods productive of sound, heat, light and Röntgen rays has brought to my mind a very interesting thought. Prof. Thomson has told us that the history of science shows that progress often depends upon a fortunate leap in the dark, and so it may not be entirely worthless. It is, that electricity itself is but a resulting effect; it may be a very short vibration period or a very long; touching a minimum or maximum, it would be imperceptible; we recognize it as electricity after it has passed through the longer vibration periods of sound, heat

Digitized by Google

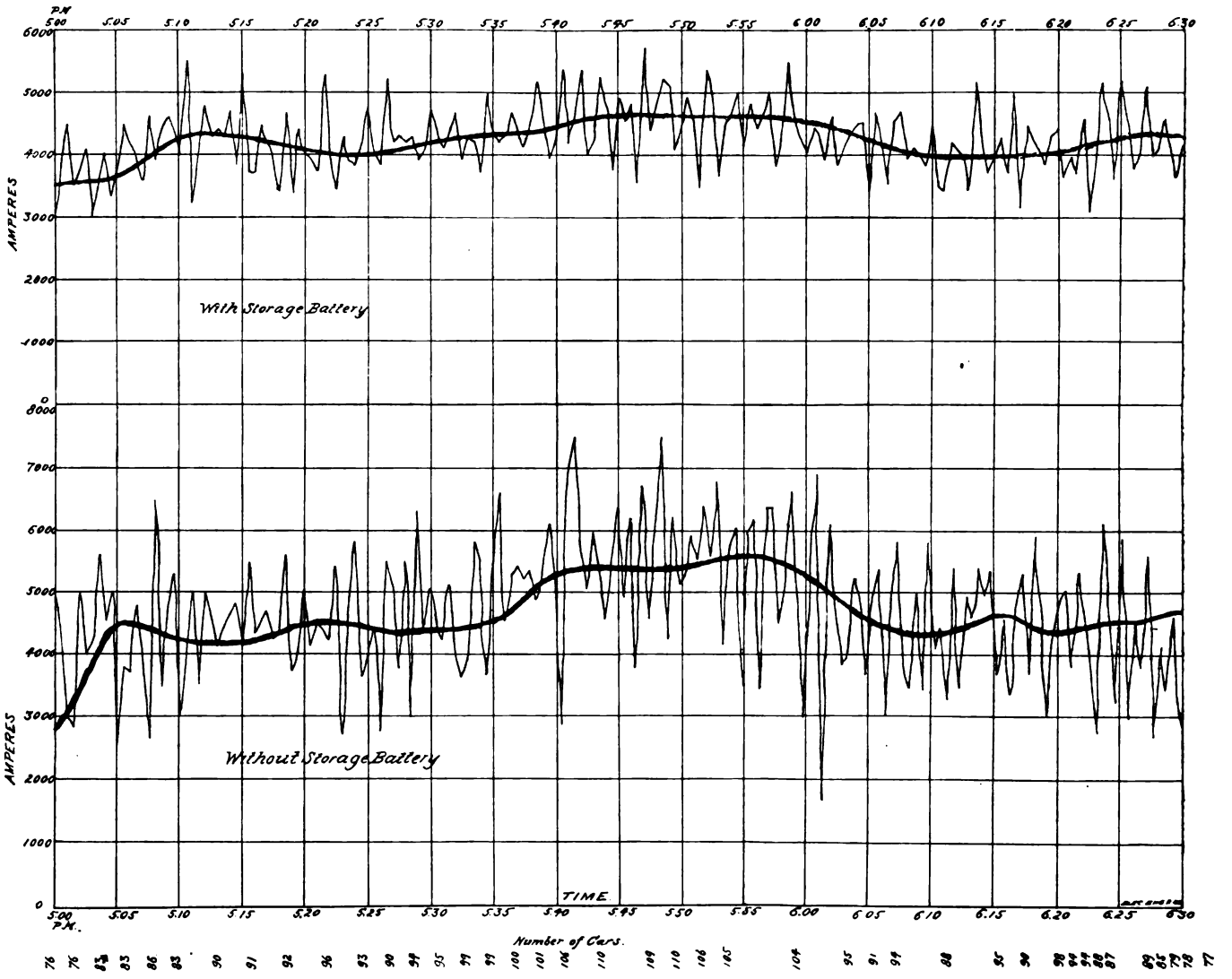
and light. We understand mechanical and chemical methods for producing these vibration periods of different lengths. We might, therefore, call electricity an effect produced by a vibration capable of a minimum and maximum period, and, according to the length of vibration period, are produced sound, heat, light, Röntgen rays and electricity, in the sense we have understood it.

A Study of the Storage Battery Performance on the South Side Elevated Railroad of Chicago.

BY J. R. CRAVATH.

THE storage battery has now become such a recognized factor as an auxiliary to large power plants that the letting of a contract for such a battery has ceased to be a matter of more than passing interest. However, a study of the uses and performance of the battery installed recently by the South Side Elevated Railroad, of Chicago, will not be out of place, as the present state of the railway power plant storage battery auxiliary is not any too well understood.

In introduction, it may be said that the load on the power plant of this company is without doubt the most fluctuating of that on any large power station in the world, because of the nature of the equipment running on the road. This was described in The Electrical Engineer of May 5, 1898. Within the past year the steam locomotives, used since the road was opened in 1892, have been replaced by the Sprague multiple unit system of electrical equipment. The Sprague multiple unit system, as most of the readers of this article are probably aware, employs motors under each car of a train, each car having a controller operated by a pilot motor, said pilot motor being controlled by the motorman's pilot motor circuit from the head of the train. Each car being a unit by itself, the fluctuations in load in this way on the power house depend directly on the length of the trains that are being operated. On a street railway, as each motor car is independent of the others on the road, it seldom happens that any large proportion of them start together, whereas, with the multiple unit system on elevated trains, the starting of one four-car train means the starting of four individual motor cars at exactly the same instant, and if several trains start at once the load of course is something enormous. Then, too, a very rapid acceleration is employed on this road, the automatic throttle of the Sprague system being set to maintain a flow of 90 to 100 amperes through each motor during acceleration. As there are two motors per car and four-car trains are now run during rush hours, this means that while the motors are in series a train will draw 360 to 400 amperes from the line, and after the motors are thrown in multiple the train will take 720 to 800 amperes, or 440 kilowatts at 550 volts. With only four 800 k. w. generators in the power plant and over 25 four-car trains to be run, it is evident that a storage battery is a desirable thing on this road, to take the peaks off the fluctuations. Of course, the fluctuations are very great on the other Chicago elevated roads, but not as pronounced as on the South Side, because the acceleration is not so rapid and the effi-



CURVES SHOWING EFFECT OF STORAGE BATTERIES, UNION ELEVATED ROAD, CHICAGO.

Digitized by Google

ciency is somewhat higher for large motor cars at the head of the train than for the larger number of smaller motors in the multiple unit system.

It became evident early in the past summer that the present capacity of the power house would not be sufficient for operating the road, since it required all four of the 800 k. w. generators to carry the morning and evening crowds, and nothing was in reserve. It was a question of more power house machinery or a storage battery. The storage battery seemed to offer the easiest and best solution of the question for several reasons. First, it would not only take the topmost peaks off the heavy loads, thereby reducing the amount of generating machinery to be kept running, but it would also smooth out the fluctuating load on the engines and generators, allowing them to run on a more steady and economical load. Secondly, it would, if installed at the ends of the line, steady the voltage and prevent excessive drop of voltage at those ends. Thirdly, it could be installed more quickly and easily than could additional generating machinery.

A contract was accordingly made with the Electric Storage Battery Company, through its Chicago representative, Mr. Frank H. Clark, for two sets of batteries, each rated at about 500 k. w.—that is, they each can take the place of about 500 k. w. in generating machinery. Each battery consists of 248 cells, each cell 24 inches high, 21 inches wide and 51 inches long. There are 27 type G plates in each cell, of which 13 are positive and 14 negative plates. These plates only occupy half of the available space in the 51 inch length of a cell, so that the capacity of the battery can in future be doubled by doubling the number of plates without increasing the number or size of cells. Each battery now, consisting as it does of 248 cells of the above dimensions, has a capacity of 1,000 ampere hours when discharging in one hour, or at a one-hour rate, and 2,000 ampere hours when discharging in eight hours, or at an eight-hour rate.

These two batteries are not placed at the power station, but are put out near the ends of the line to help avoid the drop in potential at the times of maximum demand. One battery is put at the Twelfth street station, three miles from the power house and about half a mile from the northern end of the line. The other battery is at the Sixty-first street shops and yards, about three and one-quarter miles from the power house and one and three-quarter miles from the southern terminus. The batteries are connected directly to the line without any auxiliary regulating appliances, and they take care of the fluctuations automatically. When the potential on the line falls on account of heavy load the batteries discharge, and when the potential rises with a lightening of the load, the batteries charge. The relative amount of charge and discharge of the batteries can be regulated in two ways. If it is found that the batteries are discharging more than they are charging, and thus taking more than their proper share of the load over any considerable period of time, the voltage at the power station can be raised slightly or a special feeder running direct from the power station to each battery can be cut in. If a battery is becoming overcharged by being charged more than it is discharged over any considerable period of time, the power station voltage can be lowered or the special battery feeder cut out.

We come now to the examination of the practical effect of the use of the storage battery as shown by power station load curves. In the accompanying diagram are two curves. The upper one shows the output in amperes at the power house from 5 to 6:30 p. m., September 26, 1898, and is the evening rush-hour load. The lower curve on the diagram shows the output in amperes at the power house from 5 to 6:30 p. m., September 24, 1898. It is hardly necessary to state that the upper curve represents the load with the storage battery in use, while the lower curve shows the load without the storage battery as an auxiliary. The number of cars was the same in both cases, and is indicated at various times by the figures at the bottom of the diagram. Readings were taken every half-minute at the main station ammeter. The heavy line curves in both cases are average output curves, obtained by averaging the readings of every five minutes. The maximum current shown without the batteries is 7,500 amperes, while the minimum is as low as 1,700 amperes. This minimum immediately follows a load of 7,000 amperes. While modern railway power house machinery is designed as far as possible to take care of such enormous variations safely and with fair regulation, no one can deny that it would be better to have a more steady load. The curve of current output for exactly the same traffic with the storage batteries in use, shows a maximum of 5,700 amperes, as against 7,500 without the batteries, and a minimum of 3,000, as against 1,700 without the batteries. The battery smooths out the fluctuation to such an extent that while the load was almost more than the four 800 k. w. generators in the power house could carry, the load is now hardly a full load for three of these generators. The load being comparatively steady on the three generators and extremely unsteady on the four, there must be a considerable gain in the economy of generation, with the storage batteries in use, due to the working of engines and generators at more nearly an economical load. The two curves shown are taken from two 24-hour tests taken under as nearly as possible identical conditions. The record from which the upper curve was taken lasted from 8 a. m., September 26, to 8 a. m., September 27. The batteries take care of fluctuations even better during light load hours than during the heavy load here shown. While the batteries were not put in with the idea of doing more than take care of the fluctuations from minute to minute, and were not intended to assist in carrying the high average or "peak" of the load during rush hours, the curves show that they are to a certain extent doing this. That is, the average current at the power house per car in operation during heavy load is less with the storage battery than without. Of course, this requires that the batteries be charged enough to make up for this drain at some other part of the day.

The total kilowatt hours delivered to the line at the power house during the 24-hour test with batteries September 26 to September 27, were 27,852, the total car miles 13,742 and kilowatt hours per car mile 2.03.

The total kilowatt hours delivered to the line at the power house during the 24-hour test without battery September 23 to September 24 were 28,628, the total car miles 13,742, and kilowatt hours per car mile 2.08. This does not, however, prove anything as regards the efficiency of the transmission system with and without batteries, because the battery may have discharged more than it took from the line, due to previous charges. A certain amount of energy is necessarily lost in the battery, but this is partly compensated for by the saving in C^2R line loss during heavy loads. The line loss being proportioned to the square of the current, it is much greater in proportion to the total load during heavy loads than during light. Now, the current which charges the battery passes over the line at times of light load, and as the battery is near the point of consumption and discharges into the line at times of heavy load, less energy is lost in the line than if feeding direct from power house to car, though probably more than enough is lost in the battery to make up for this gain. The gain in economy of generation due to the more steady load is another matter, and can only be determined by tests in the power house.

Aside from the question of storage batteries, it is interesting to note the kilowatt hours per car mile required on this road, which is 2.08. This does not seem excessive, since the schedule speed is about 15 miles per hour. It is considerably higher than on the other Chicago elevated roads, but the schedule speed is also higher. The use of so many small motors, of course, gives a lower efficiency than a single motor car at the head of the train. The only figures I have at hand which could fairly be compared with the figure of the South Side elevated are some tests of two car trains made by M. H. Gerry on the Metropolitan West Side Elevated Railroad, of Chicago, and presented in his paper before the American Institute of Electrical Engineers at its annual meeting in June, 1897, and printed in The Electrical Engineer. These, however, are only the results from single-trip tests. One trip made at a schedule of 14.9 miles per hour, with a two-car train, consumed 1.67 k. w. hours per car mile, and another trip made at a schedule of 15.9 miles per hour consumed 1.69 k. w. hours per car mile. These tests were made, however, with motors wound for too high a speed to give the most economical results, whereas, the South Side elevated motors are of the most economical speed for such schedules.

For the curves and data given in this article the writer is indebted to Messrs. Sargent and Lundy, the consulting engineers of the road.

PHILADELPHIA. The Union Traction Co. is adding to its car equipment at the rate of twenty new cars a month, these cars being 28 feet long, to carry 50 per cent. more passengers than the old cars.

MR. JOHN H. MOFFITT, general manager of the Syracuse Rapid Transit Co., has resigned from Oct. 1

Digitized by Google

Track Construction, Its Present Defects, and the Remedy.

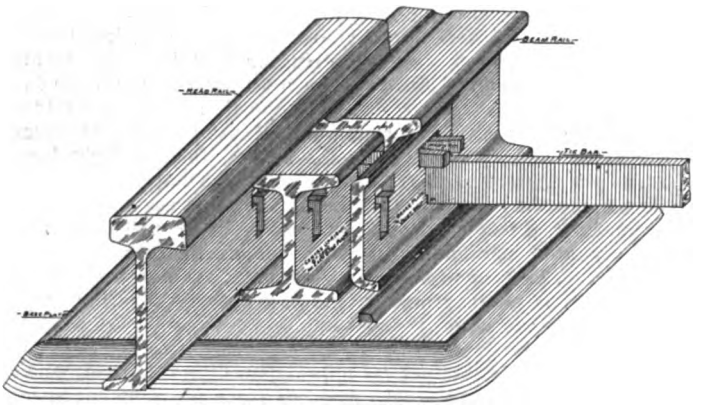
BY THOMAS H. GIBBON, C. E.

THE appreciation of electricity as the leading power of street railways and the present defective track, has forced many radical (but not improved) changes in track construction. Railway managers have been induced to increase the weight of rail from 60 pounds per yard to 90 and even 100 pounds per yard for a 40,000-pound electric car, pivoted on eight points to run upon a rail preposterously heavy for the small weight it has to sustain. They have been induced to double the length of the rail, which is not economy, either in first labor cost, or renewals, and a few managers have been induced to weld the rails to get away from lamination and low joints, making no provision for expansion and contraction of rails. This is jumping from the frying pan into the fire.

They still use the badly designed rail, that neither supports the paving (without filling) nor supports the cars with accuracy —which is required for equal distribution of rolling load and smooth travel.

They still adhere to the tallow candle—timber ties—which soon burns out, instead of using the arc light—metal substructure—which is almost perpetual. In fact, with all the past years or toil and trouble, and the yearly discussions and mutual sympathies on track annoyances and expenses, they still wallow in the groove of the early pioneers—timber, spikes, bolts, etc. They have gone further, only in the increased first cost and have not lessened the evils.

Mr. Bowen, in his able paper read before the St. Louis Street Railway Convention in 1896, told of his trials and tribulations and explained very clearly how the enormous expenses have in-



GIBBON LAP JOINT RAIL.

vaded every department of railway service, caused by low joints and bad construction of track; and the quack medicine he has given the track by welding and lengthening the rails will be a boomerang, when that day of reckoning comes—renewals. Then the army of men will invade the streets with carts, picks, saws, chisels, sledges and bars, to cut up and cart away the mass of misconstruction.

I do believe (although the evil influences still strongly prevail to keep in the old rut) that the managers would like a perfect track which must possess the following requisites:

1. All material to be of an imperishable character.
2. Its design must be simple and few in parts, and easy of access, so that only the part worn may be renewed with rapidity and with little disturbance to the street pavement.
3. It should possess lateral as well as vertical strength, and be able, under any circumstances, to keep true alignment, grade and gauge.
4. It should have absolute, permanent contact of metal throughout the whole length of line, without welding or bonding, and under every and all circumstances be free from any depressions at the connection of rails, in order that the load which it has to carry may be transmitted uniformly, steadily and rapidly, with the least possible oscillation.
5. It should be of the stringer form, to act as a wall for the support of the paving. This would do away with the expensive filling, now incurred by the spindle system.

The rails should be so designed that while all parts are locked together for unity and strength, they should act individually for expansion and contraction; and last, but not least, they should have elasticity, not rigidity. The former gives friendship between wheels and rails; the latter makes enemies between the rails and wheels and a bitter fight, the final end of which is destruction to both.

To obtain such an ideal track, we must obliterate the present crude and imperfect construction and apply those principles which are applied in every other department of mechanics. We must take the metal of this imperfect overgrown rail, knead it over and shape it into athletic form, that it will stand up without welding. In fact, build it as a mason does his wall or a sailor splices his rope, lap joint, and by a series of these lap joints, make a continuous whole and of equal strength.

The modus operandi to make this ideal track is simple, very simple. The parts are very few in comparison and all metal. The accompanying illustration shows (although other types can be used): 1st—The convex base plate. 2d—The upright on the base plate. 3d—The notched tie-rod and track gauge. 4th—The rail. 5th—The joint plate. 6th—Wedge key.

The rail is made in two separate sections; the "head" section and the "flange" section. The head section has a girder directly beneath the centre of the bearing surface. The flange section presents a bearing surface similar to the flange of a side bearing rail and has a girder directly beneath the centre of the bearing surface. The two sections combined form a double girder bearing rail, the girders acting as a wall for the support of the paving.

The convex base plate is of pressed steel, with large area of bed plate surface. The upright is also of steel; the lug passing through the base plate, locks itself to said base plate. The tie rod is of wrought iron or steel, notched to the gauge required. Said notches engage in the T mortices of the rails and uprights, thus gauging the track. The bifurcated wedge keys are of iron or steel, which are driven over the tie bars and through the mortices in the rails and upright, and all the parts are thus firmly locked together.

In laying track, in macadam or other pavement, dig longitudinal trenches 18 inches wide and 6 inches deep (or any depth of pavement), with small lateral trenches every 6 feet for tie rods. Then place and space (3 feet apart) a series of base plates and upright in position, using knotted rope, for alignment and spacing the base plates. Then commence by laying a 15-foot tram rail, followed by 30-foot rails. Four men comprise this gang of laborers.

Then follow by "head" rails 30 feet in length. This breaks joints, making the solid head rail cover the ends of the "tram" rail 15 feet on each end of the rail connection, and where the "head" rails connect they are supported by the solid tram rail; and thus by a series of under and over lapping, which makes a perfect contact of metal throughout the track. Then follow up by putting the joint plate in position and tie bar through the mortices in the rails. This operation secures the rails together and gauges the track also. Then drive the wedge keys over the tie bars and through the T-shaped mortices in the rail and upright. This action secures all the parts firmly together.

The slotting in the rails, being longer than the width of the wedge key, provides for the expansion and contraction of rails.

It should be noted right here that only eight pieces constitute the track complete at the joint. Compare that with present mode which uses from 30 to 70 pieces, according to choice of manager.

You will see by this construction that only four gangs of four men each, with one man for the rods, and two men for driving keys, constitute the rail gang force, and I here state, that I will lay and accurately gauge 60 feet of track, in the same time it takes to screw up and accurately connect two joints of the splice bar system.

The electrical and mechanical engineers have groomed their steeds, that they have become things of speed and strength. The car builder has given palaces on wheels to ride in, and the civil engineer, or somebody else, has given a corduroy road to travel on, as shown on Third and other avenues in this city, and throughout the country.

I hope that my exposition of track construction will cause a close investigation of this most of all important subjects. There are plenty of good things in the lap-joint household; let managers and constructors look into it, and they will change their track diet and come and partake of the pure and wholesome lap-

Digitized by Google

joint diet. If they do, their bodily and mental faculties will be refreshed and the investors will get ample interest for their money.

To What Extent Should Street Railways Engage in the Amusement Business?[1]

BY WALTON H. HOLMES.

STREET railways are peculiarly an urban agency. They were born of the wants and convenience of a city population, and the development and growth of travel are so closely associated with the growth and prosperity of the municipality that street railway managers can never be too zealous and active in every public enterprise which is designed and well calculated to stimulate municipal expansion and civic pride among its citizens. This is notably an age of progress in every line and in all directions. The ideal city of a few years ago is no longer considered adequate in its appointments for the welfare of its inhabitants. Every up-to-date city in the land has come to acknowledge that it owes a larger duty to those who live within its boundaries than merely to afford police and fire protection. The comfort and pleasure of its inhabitants must now also be considered and looked after, and this tendency and demand of the age has crystallized and taken form in providing parks and squares for the comfort, pleasure and entertainment of the great body of the people and drives and boulevards for those who are more favored in the distribution of worldly goods. These public pleasure resorts are an important factor in the question under discussion.

The street railways have a great and peculiar interest in these public parks. It is our mission, as a public agency, to render them as accessible and useful to the people as possible, and to this end it must be apparent that by a reasonable expenditure of money towards the amusement and entertainment of the people in their own resorts, street railway travel can be stimulated and the health and welfare of the community greatly promoted at the same time. Results are more easily obtained by encouraging a natural tendency of the kind referred to than by efforts to entirely create business through independent and artificial means. With rare exceptions, commissioners of these public parks look upon them as the inheritance of the people, and regard it as a solemn duty to encourage the efforts of the street railways to render them as accessible and pleasant for the inhabitants as possible, and are only too glad to have their own endeavors in the same direction supplemented by the street railways.

Public parks are usually numerous and scattered in different localities, and in this lies a great advantage to the street railway over the maintenance of a private resort of its own. In the one case travel becomes congested with the increased danger of accidents and maintenance of a surplus amount of idle equipment for a large portion of the year, while in the other public patronage is more generally distributed where it naturally belongs and serves to keep better employed the standard equipment of the line without much additional expense or risk.

With reference to parks and similar resorts, I therefore think it may fairly be deduced that street railways have generally found their maintenance on private account to be ill-advised and unprofitable except in a few localities where locations are such as to warrant more than the ordinary five-cent fare, and that the best results are to be secured by intelligent aid of the public municipal authorities in their efforts to render their own resorts attractive, pleasant and entertaining to the great body of the people.

Street railways have seldom undertaken to foster other than out-of-door amusements, and these are always attended by the risk of bad or unseasonable weather and the like, which frequently entails heavy loss. Cars must be accumulated in large numbers where such attractions are being presented in order to take the people away at the proper time, thus greatly increasing the cost of car service and sometimes necessarily retarding the tide of regular travel at other places with the attendant loss. Such enterprises frequently engross much valuable time of the chief managing officers which would otherwise be expended in other directions. These and kindred considerations which will readily occur to the experienced railway manager, are very potent reasons why the companies should not themselves engage in the amusement business. Many of these things are impossible to estimate in dollars and cents, and so it is that street railways are every day coming to realize more and more forcibly that the business to be relied on for profits is that which follows the natural channels and can be handled in the usual and ordinary way.

I need hardly say that some of our large cities have reached a point where the ideas advanced in this paper have no practical application. With some of them the problem is not how to create or stimulate travel, but rather how to best handle and take care of the patronage which is already at hand. Then again, there are many small cities which have not yet attained to that important rank which justifies the public authorities in undertaking to provide for the pleasure and amusement of the people at large. Street railways thus located have frequently found it profitable in a degree to supply this want on their own account, and to them the views here presented are likewise of little practical importance.

Where amusements are to be provided or encouraged at all general experience shows that there is little or no difference of opinion as to the character of entertainment which ought to be furnished. The view entertained is well nigh universal that expenditures in this behalf should be moderate in amount.

In many of the Southern and Western cities visitors are few and business comparatively dull in the summer season, with much of the resident population sojourning at the seaside or in the mountains, and half-holidays, with business houses generally closed are by no means infrequent. This condition means light travel on street railways unless some inducement outside of the ordinary is afforded to those who have remained at home. Amusements and entertainments of the kind to which I have referred have been found to be well adapted to this purpose, and in many instances have proved to be undoubtedly profitable to the street railway.

[1]Read before the Am. St. Ry. Assoc. Abstract.

Calcium Carbide Works, Niagara.

THE Union Carbide Company have just closed a contract with the Niagara Falls Power Company for 5,000 additional electrical horse power, and will very soon commence enlarging their plant on the power company's lands in order to use this additional large amount of power. The carbide plant is located east of the Niagara Electro Chemical Works, and since the manufacture of carbide was first started at Niagara Falls it has frequently and substantially been enlarged. The illustration shows it as it is to-day. It has been materially improved since

FACTORY OF THE UNION CARBIDE CO., NIAGARA FALLS, N. Y.

the Union Carbide Company became the owner of it, and it is understood they will now extend it to the amount of about $100,000, and give employment to many more men.

It is evident from this contract for such a large additional amount of power that the Union Carbide Company will make Niagara Falls one of the principal centres for the manufacture of carbide in the United States. When the company was organized they announced their plants at the Sault Ste. Marie and Niagara Falls would be continued, and this enlargement of the Niagara plant shows they recognize the value of the constant power service of the Niagara Falls Power Company. It will be observed that the contract calls for the entire current output of one of the great dynamos in the power company's central station.

Digitized by Google

NEWS & NOTES

The Caracas Warehouse—A Boon to American Manufacturers.

EARLY this year the official inauguration by President Andrade, of the American Sample Warehouse, aroused considerable interest among American manufacturers and financiers, as it appeared to open up a large field of usefulness for American manufactures. Since that time great strides have been made in the organization of the work in this institution, according to a recent report of Consul Goldschmidt, recently published by the Bureau of Foreign Commerce, Department of State. The large and spacious building is now filled with a great variety of exhibits representing all the different industries fostered in the State. They are grouped in various rooms according to trades, which makes a very attractive and at the same time comprehensive showing. Not far from the various office and furniture exhibits, near the entrance of the building, are large rooms devoted to the accommodation of the American traveling salesmen who are passing through Caracas and wish to display their samples under the most advantageous conditions. In the spacious corridor leading from the main part of the building to the power house the Ft. Wayne Electric Company have installed one of their electric light plants, which it is expected to show in conjunction with various kinds of power plants, such as steam, gas and petroleum engines. In the words of the Consul: "American manufacturers in this line should realize that there is afforded to them one of the most excellent and at the same time economical means for illustrating the advantages of their respective machinery. In this country, where almost entire absence of railway or other means of communication besides mule path adds so enormously to the cost of fuel, and where in many instances the weight and bulk of the machines thus prohibits their transportation, the native wants to see in practical operation the machines which he is going to buy. This warehouse affords such opportunity." It is the intention of the management to utilize the large open space as a machinery hall, and this will afford a splendid chance for manufacturers of all classes of machinery to display their goods to advantage. In another portion of the building are shown musical goods, another is devoted to dry and furnishing goods, and in the central portion, which is now used by the Caracas Bourse, is located a valuable library, which contains nearly every prominent trade journal of the United States. Adjoining the library is a spacious apartment devoted exclusively to Venezuelan products, agricultural, mineral and industrial, which has the hearty support of the Government.

It is further proposed to make this warehouse, so to speak, the centre for a commercial course, thus giving young Americans an opportunity for gaining a thorough knowledge of the Latin-American market without entailing a great loss of time that is ordinarily met with when acquiring knowledge by serving in some native establishment.

Regarding the organization of the warehouse, it should be stated that it is divided into fifteen general groups or departments, and to each day of the week are assigned from two to three subjects according to their importance. The main office of the Association is at Philadelphia, and a neat sixteen-page pamphlet on the subject, published by the National Association of Manufacturers, gives full information regarding the cost and conditions of exhibiting at the Caracas Warehouse. The cost is so light that it is to be hoped American manufacturers will promptly avail themselves of the opportunity. The management assists manufacturers in securing competent and reliable agents for their respective goods and every way facilitates the building up of trade. In conclusion, we may give the list of electrical goods suggested by the Consul to American manufacturers for exhibiting purposes. These are: Electrical machinery, electric railway equipment, telegraph and telephone material, wire for electrical purposes, electric light fixtures, electrical supplies in general, telegraph poles, electro-medical apparatus and electrical instruments.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued October 4, 1898.

Alarms and Signals:—

SIGNAL APPARATUS. H. G. Leopold, New York, 611,638. Filed Sept. 3, 1897. Adapted for use in engine room telegraphs on shipboard.

SIGNALING. J. P. Coleman, Edgewood Park, Pa., 611,894. Filed Jan. 3, 1898. Means whereby the return of an electrically actuated signal to danger position can be insured.

ELECTRIC SIGNALING DEVICE FOR RAILWAYS. L. T. Dube, Paris, France, 611,897. Filed Dec. 6, 1897. Provides a signal between approaching locomotives on the same track in which the source of electricity is carried on the locomotives.

RAILWAY SIGNALING. J. G. Schreuder, Edgewood Park, Pa., 611,943. Filed Jan. 3, 1898. Employs a motor for shifting the signals, independent connections from the signals to the motor, a lock for holding each signal in clear position, a magnet controlling each signal connection and lock, and a track circuit controlling the circuits of the motor and of the controlling magnets.

Conductors, Conduits and Insulators:—

ELECTRICAL CONNECTOR. J. Pedriali, Brussels, Belgium, 611,707. Filed March 30, 1898. Intended for connecting the conducting cables between two railway cars, one of which is the motor and the other the trailer.

Distribution:—

APPARATUS FOR ADJUSTING PHASES OF ALTERNATING CURRENTS. J. H. F. Görges, Berlin, Germany, 611,902. Filed Dec. 27, 1897. Apparatus for dividing a single alternating current into two currents displaced as to each other by a definite phase angle.

METHOD OF AND MEANS FOR CONTROLLING ENERGY DELIVERED TO TRANSLATING DEVICES. H. W. Leonard, East Orange, N. J., 611,970. Filed Jan. 21, 1896. Designed for the control of electric motors operating elevators, cranes, cars, or other machinery designed to be operated at varying speeds or at constant speed and varying torque.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. S. Bergmann, New York, 611,601. Filed July 10, 1897. Consists of an adjustable electrical resistance for enclosed arc lamps.

DEVICE FOR SUSPENDING ARC LAMPS. J. Borka, Buffalo, N. Y., 611,766. Filed March 4, 1898. The lamp is suspended from a mast-arm by means of rope and pulley. Details of construction.

Measurement:

ELECTRICAL MEASURING INSTRUMENT. E. Weston, Newark, N. J., 611,722. Filed Jan. 10, 1898. Is provided with a movable coil, pivot supporting plates having axially drilled holes in combination with pivot pins or bearings secured therein by forcing them endwise.

INDEX NEEDLE OR HAND FOR ELECTRICAL MEASURING INSTRUMENTS. E. Weston, Newark, N. J., 611,723. Filed Jan. 10, 1898. Constructed wholly of aluminum and consists of a supporting part having radially disposed arms, a body part and a thin flat pointer having a strengthening bead.

ELECTROMETER. E. Weston, Newark, N. J., 611,724. Filed Feb. 14, 1898. Consists of stationary and movable electrostatic parts, and an indicating needle for the movable part, all being enclosed in an insulated metallic casing.

ELECTRIC METER. S. Evershed, London, England, 611,809. Filed Dec. 21, 1897. Comprises a vertical rotative axle, a self-actuated counting train and means upon the axle to control the speed of the train.

MULTIPLE RATE METERING SYSTEM. F. T. McIntyre, Washington, D. C., 611,927. Filed March 25, 1898. Employs two independent meters having their register-controlling elements connected in independent branches, independent control wires connecting the branches with the control station, and a switch mechanism for completing the circuit through one of the control wires and meter in circuit therewith.

Miscellaneous:—

ELECTROMAGNETIC ENGINE. P. B. Watson, Philadelphia, Pa., 611,850. Filed May 9, 1898. The current for the magnets is supplied from storage batteries. Details of construction.

ALARM LOCK. E. N. Case, Chicago, Ill., 611,992. Filed Jan. 3, 1898. Details of construction.

Railways and Appliances:—

TROLLEY EAR. H. Geisenhoner, Schenectady, N. Y., 611,752. Filed July 15, 1898. Is secured to the trolley wire by compressing the metal forming the wire around the ear.

SURFACE CONTACT RAILWAY SYSTEM. W. B. Potter, Schenectady, N. Y., 611,760. Filed Nov. 29, 1897. Details of construction.

ELECTRIC RAILWAY. J. B. Entz, Philadelphia, Pa., 611,778. Filed Dec. 21, 1895. Designed to be operated by alternating current.

ELECTRIC RAILWAY CONDUIT AND TROLLEY. J. H. Robertson, New York, 611,821. Filed Oct. 20, 1896. Comprises electric conductors in the form of track rails having their upper surfaces exposed for the reception of conducting shoes, insulating supports located beneath the conductors, plates for securing the conductors to their insulating supports at intervals, and cement fillings interposed between the conducting rails and the sides of the cement fillings being inclined downwardly and inwardly from the sides of the conduit.

Switches, Cut-Outs Rheostats, Etc.:—

ELECTRICAL CIRCUIT CONTROLLER. N. Tesla, New York, 611,719. Filed Dec. 10, 1897. The circuit controller is contained within a closed receptacle and surrounded by an inert insulating medium under pressure.

ELECTRIC TIME SWITCH. F. M. Schmidt, J. H. Gerry and W. S. Barstow, New York, 611,822. Filed Nov. 18, 1897. Designed especially for use on arc light circuits.

AUTOMATIC SWITCH APPARATUS. A. Schlatter, Buda-Pesth, Austria-Hungary, 611,869. Filed Sept. 21, 1897. Designed for alternating current systems of distribution.

Digitized by Google

Telegraphs:—

TELEGRAPH KEY. F. E. Lewis, Jefferson, Texas, 611,919. Filed Dec. 2, 1897. Comprises a base, upright bearing posts and a key-lever spring stamped from sheet metal and bent to proper shape.

Telephones:—

AUTOMATIC SWITCHING AND TELEPHONE SYSTEM. L. G. Nilson, Sioux City, Iowa, 611,974. Filed March 9, 1896. Consists of a box adapted to transmit electrical impulses, a retarding appliance consisting of a pivoted balance, projecting parts extending from a passing body, and two slidable pallets adapted to be alternately moved by the projecting parts of the passing body.

REPORTS OF COMPANIES

The N. Y. Gas and Electric Light Heat and Power Co.

The New York Gas and Electric Light, Heat and Power Company, with a capital of $25,000,000, has been incorporated at Albany and has paid its tax on capitalization. Its stated objects are to manufacture and supply gas and electricity for light, heat and power purposes in the territory of Greater New York. The corporation is to have the right to purchase and hold the stocks and bonds of any foreign or domestic corporations and exchange therefor its own stocks and bonds. The organization tax of $31,250 was paid to the State Treasurer by a check of the Central Trust Company, drawn on the Bank of America. The directors are Henry J. Hemmens, Frank D. Allen, Frederick L. Allen J. Frank Yawger, Louis M. King, Charles N. Flint and Nathaniel W. Smith, of New York City. Mr. Hemmens is a partner of Samuel A. Beardsley, who is said to be associated with ex-Governor Flower in ventures in trolley lines north of the city. Few incorporations in New York City have aroused more public curiosity than this, and the rumors in regard to it are without end. The Central Trust Company has been associated with the Flower and Brady interests in other transactions.

It is stated that this new company has already bought up the old Block Lighting Company, and other interests.

New Orleans Traction Reorganized.

The New Orleans Traction reorganization plan creates a new company to own all the property of the old company and to issue $3,000,000 new bonds, $2,500,000 new preferred and $5,000,000 new common, which, together with the $3,141,800 undisturbed bonds, makes the total bonded debt of the new company $6,141,800 and the annual requirements for charges and taxes $380,013. The company reports earnings nine months to Sept. 1, 1898: Gross, $1,007,630; operating expenses, $622,097; net from operation without deduction of taxes for nine months, $385,532, plus power house earnings, $25,347; total net without deduction of taxes, $410,880. This is equivalent to the full dividend on the preferred, assuming that charges are earned in the next three months.

SOCIETY & CLUB NOTES

Journal of the Association of Engineering Societies.

The Journal of the Association of Engineering Societies for August contains three papers on the "Abolition of the Grade Crossings on the Main Line of the Boston & Albany Railroad, in Newton, Mass.," by Messrs. Irving T. Farnham, William Parker and W. G. S. Chamberlain, of the Boston Society of Civil Engineers, and one on "Power Consumption on Electric Railroads," by S. T. Dodd, of the Civil Engineers' Club, of Cleveland (already printed in The Electrical Engineer). In the first series of papers Mr. Farnham deals with the history of the improvement and with the street and drainage work connected with it, Mr. Parker with the depression of the railroad tracks and Mr. Chamberlain with the bridges over the tracks. All the papers are freely illustrated. Mr. Dodd, in his paper, gives a scholarly analysis of the several items of work performed by the electric current on railroads, and illustrated his paper by diagrams giving speed, torque and acceleration curves.

LEGAL NOTES

Taxation of Electrical Patents as Property.

The assessment imposed by the Brooklyn assessors upon the capital stock of the Edison Electric Illuminating Company included $945,000, "the value of certain patent rights owned by the relator which had been granted by the United States for certain inventions." The Court of Appeals has affirmed the decision of the Appellate Division of the Supreme Court vacating the assessment on the ground that patent rights were not taxable by the State. Chief Justice Parker, giving the opinion, says: "The question cannot be considered an open one, for the Supreme Court of the United States long ago asserted that they could not be taxed by the States." After briefly stating the argument in support of the doctrine, Chief Justice Parker says: "The appellant insists that another question is presented, which, if answered in the negative, will fully justify the assessment made. The question is this: Assuming that patent rights are not taxable by the States, and that the capital stock of an electrical company is used to pay for the use of methods and appliances of a parent company, protected by patents, can it be said that this stock is invested in patent rights within the general principles that patents are not taxable? But there are no facts before us upon which we can consider this question."

THE STOCK MARKET

The Public Too Busy to Speculate.

ALTHOUGH there appears to be great activity on the stock market, it is to be noted that the briskness centres just now in one or two stocks, which serve the purposes of professional footballs. Of the 2,000,000 shares of stock sold last week, more than half was in four securities, two of which were "sugar" and "tobacco," both of which have been hammered so low as to have scared away any outsider. Meantime, general trade conditions would indicate that most people are attending to business and letting the stock market alone, except for strictly investment purposes.

During the week, 4,411 shares of Western Union were sold, closing at 91⅝. Of General Electric, 5,236 shares were sold, closing at 79⅛. Of New York Edison the large sales of 1,220 shares were reported, closing at 120. Metropolitan Street Railway sold to the extent of 45,392 shares, rising to 164. In Boston, American Bell Telephone sold at 280 and West End at 86.

The volume of business in the metal trades continues very large, and seems likely to stay that way. Heavy steel rail, Eastern mill, is quoted at $18. Copper, New York, is 12¼ cents and lead 3.90.

PROF. F. B. CROCKER, who now takes his "sabbatical year" vacation at Columbia University, New York City, leaves this week for a trip around the world. He will be gone about ten months.

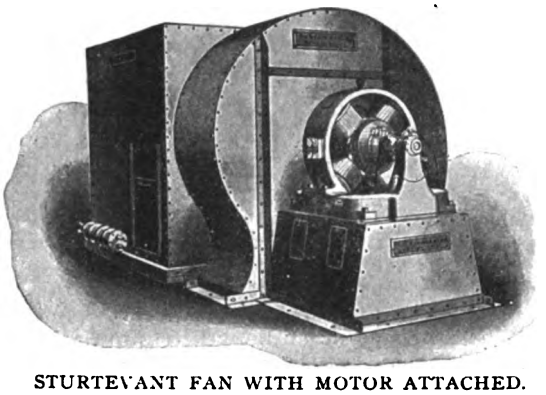
HARTFORD, CONN. The death is announced of Mr. W. H Babcock, manager at Hartford for the Southern New England Telephone Company.

Digitized by Google

TRADE NOTES AND NOVELTIES

The Sturtevant Electrically Driven Fan.

THE accompanying illustration shows one of the numerous types of Sturtevant heating and ventilating apparatus with electric fans. This apparatus can be introduced when the steam pressure is too low to permit introducing an engine for operating the fan, and thus a forced system of ventilation and heating can be provided. In the illustration shown a multipolar motor is supported on a substantial bed, and its shaft is extended to carry the wheel. The fan inlet is unobstructed, and the motor is rendered free from the effect of heated air passing through the fan. Various types of motors enclosed or open can be furnished. An electric fan can be arranged to blow through or draw through the heater, the sizes ranging from 2 to 6 feet diameter of



STURTEVANT FAN WITH MOTOR ATTACHED.

wheel. Numerous other types of heating and ventilating apparatus are manufactured by the B. F. Sturtevant Company, of Boston and New York, all of which are described in a very complete catalogue, which will be sent to any one on application. Another neat circular recently brought out by the company is one illustrating the advantages of draft, without chimney, in which they claim that the latter has outlived its usefulness and pointing out the advantages of mechanical draft. The company's Bulletin A describes various types of direct current motors and generators manufactured by this company. Motors are made in sizes varying from 1 to 100 h. p. and dynamos from 7½ to 80 k. w.

The General Electric Co., of England.

MR. W. H. BEVIS, the manager of the General Electric Company, of England, one of the largest manufacturers there, is on a visit to this country, representing the large variety of apparatus made by them. A special line is their Hunning Cone Deckert Transmitter, the construction of which seems particularly ingenious, the fault with the majority of the Hunning transmitters being the liability to pack and consequent loss of efficiency. In the Deckert cone this has been overcome by a simple and ingenious method. We learn that this transmitter has been accepted in competition with all other types by the National Telephone Company, of England, who have already over 100,000 in use. It has also been accepted by the English Government Post Office and other official departments.

We are informed that at the present moment there are at least 600,000 of these transmitters in use for long and short distance work. One of the most important articles with regard to which Mr. Bevis is very sanguine, is the "New Aron Meter." This promises to be a most important addition to the meter market. As many of our readers are aware, the old pattern of Aron meter was a beautiful application of electrical measurement, but it had the serious drawback of requiring winding up every month, depended on the nice synchronism of two pendulums, and could not be sent out sealed from either the makers or from central stations. All these difficulties after some four years' work have been entirely obviated. It is now about of a size with other meters, is sent out sealed from the makers, and requires no winding up or other attention whatever. The makers will guarantee that even so large as a 500 ampere meter will register with a single 16 candle power lamp. It is a true watt hour meter and registers directly in units.

The statements put forward by Mr. Bevis seem to some extent justified, as the English Board of Trade have just passed it as a standard meter after a series of tests lasting over two years. This forms without doubt a substantial guarantee that the meter is all that is claimed for it by the makers. A new company is just formed in England with a subscribed capital of £250,000, and Mr. R. E. Crompton, Sir James Pender, Mr. R. Wallace, Q. C., Mr. G. Binswanger Byng and Dr. Aron are its directors. It is the intention of the parent company to part with their rights for this country and to form a separate company here for the manufacture and sale here.

Popularity of Montauk Multiphase Cables.

Of late the Montauk Multiphase Cable Co., New York, have received numerous letters referring to the satisfactory working of the cables installed by them. One of these letters reads as follows:

OFFICE OF THE MILWAUKEE AUXILIARY FIRE ALARM COMPANY.

Milwaukee, Wis., Oct. 1, 1898.

Montauk Multiphase Cable Co., New York.

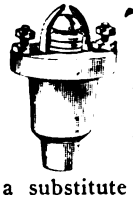
Gentlemen—I am pleased to say that the Fire Department endorses and authorizes your cable for use in connection with our auxiliary system here, Chief Foley telling me recently to "go ahead" with it. Superintendent Glassner, of Fire Alarm Telegraph, has expressed himself as satisfied. Yours truly,

(Signed) THOS. R. MERCEIN.

Goubert Mfg. Co.

The Goubert Manufacturing Company, of New York City, manufacturers of the Goubert feed water heater, state that they are at present exceedingly busy. The magnitude of modern steam plants is well exemplified by the fact that they have just booked the following orders: One 3,000 h. p. heater for one of the New York and Pennsylvania Company's pulp mills. One 3,000 h. p. heater for the Cleveland Railway Company, Cleveland, O. One 5,000 h. p. auxiliary heater for the Metropolitan Street Railway Company, of New York City, making 35,000 h. p. now building for that company alone. They have also just delivered 3,000 h. p. to the People's Electric Light Company, of Newark, N. J. These orders, in addition to the regular calls for heaters of smaller sizes, among them 1,000 h. p. for the Schenectady Railway Company and 1,800 h. p. for the Citizens' Light and Power Company, of Houston, Tex., are indicative of the magnitude of the business being done by the Goubert Company.

New Bogart Electric Gas Lighting Burner.



THE cut herewith illustrate a new form of burner, or tip, to be employed in connection with series electric gas lighting apparatus, otherwise improperly known as "multiple," a form of gas lighting in which a number of jets are to be ignited simultaneously, as in theatres, churches, etc. It presents a number of novelties. It is intended as a substitute for the common lava tip in the ordinary pillar burner, or what is known as the candle burner, the base being arranged to fit the metal socket designed to receive and carry the common lava tip in either of the forms of burners referred to. The novelty consists in the use of porcelain in the place of steatite or "lava," as employed heretofore for such purposes. It is claimed by the manufacturers that lava is a poor insulator where currents of high potential are employed, such as are produced by the frictional machine or Rhumkorff coil—the usual generator in such cases.

In the new tip porcelain is substituted, as it has proven itself to possess far higher non-conducting characteristics and to be less liable to breakage either through accidental blows or on account of increase of temperature due to the flame. This makes the new tip more durable and lasting and permits of a greater number being lighted in one series. The top of the body is provided with grooves, in which the electrodes are located, which prevents the latter from shifting from their proper position and

Digitized by Google

thus changing or increasing the length of the spark gap, for which they are originally set. Another new feature consists in the means for attaching the circuit wires to the electrodes. Heretofore this has been achieved by providing holes in the electrode which projected beyond the body of the burner. In the improved form, binding screws are provided, by which a sure connection can be made with great ease and neatness, the nuts being prevented from becoming lost by heading the upper end of the screw.

The tip is very attractive in appearance, being white, but may be colored at will to match the tint of the candles upon which it is mounted. It is being manufactured by the A. L. Bogart Company, of 123 Liberty street, this city, who are making a specialty of this class of apparatus.

CATALOGUES.

The Garvin Machine Company.

This well-known company, located at Spring and Varick streets, New York, manufacturers of and dealers in machine tools and special labor-saving machinery, have just issued a general catalogue of the various machine tools which they handle. The book is amply illustrated and contains a great deal of valuable information to machinists and engineers. It is well indexed, contains 125 pages and will be sent to anyone on application.

Manila Rope.

This is the title of a very useful and handsome catalogue on manila rope for transmission and hoisting, recently issued by the C. W. Hunt Company, 45 Broadway, New York, and is a brief treatise for engineers on ropes used for transmitting power, together with formulæ, tables and data useful in mill engineering. It gives a complete history of manila rope and of its manufacture; chapters on splicing, knots, hitches and bends; interesting pictures showing ancient and modern rope transmission, a chapter on stevedore transmission rope, grooved pulleys, and chapters as well as valuable curves on rope driving. In the appendix are given a large number of instructive diagrams, showing the different methods of rope driving, reprinted from the transactions of the I. M. E. of Great Britain. The book will be sent to anyone on application. Other interesting books issued recently by this company and described in our columns are entitled "Industrial Railways," "Mast Fittings," "Coal Tubs," "Hoisting Blocks" and "Wheelbarrows," each of which is a complete treatise on the subject with which it deals.

Fort Wayne School of Electricity.

A small pamphlet illustrating the various courses taught in this school and giving a calendar for the coming session has been received, and shows that the courses taught are thorough and practical. Thirty complete subjects are taught and a number of visits and examinations are made by the students. The tuition fee for the entire course is $15, and the textbooks used are "Electricity and Magnetism," by the National School of Electricity, and the Electrical Engineering Leaflets, by Houston & Kennelly. The school is conducted by A. L. Hadley and Thomas Duncan, both with the Fort Wayne Electric Corporation.

PELHAM, N. Y. The workmen of the New York, Westchester & Connecticut Traction Co. were recently "drowned out" by the local firemen while trying to rush through a line of trolley tracks.

BROOKLYN, N. Y. An electrical pacing machine shown recently on the Manhattan Beach bicycle track was violently assailed by a number of pacemakers, who left it a wreck before the peacemakers in the shape of the police could arrest the miscreants. The inventors are very much discouraged.

ADVERTISERS' HINTS

ELECTRIC APPLIANCE COMPANY, Chicago, in one of our advertising pages, are calling attention to their new self-contained automatic hook. This hook is exclusively their design and manufacture, and a number of very strong claims are made for it. It is very easy to install and occupies very little space. It is put together complete and adjusted before shipping, and is therefore sure to reach the customer in good shape. The contacts are always visible upon opening the door, which makes it easy at any time to see that everything is in working order. The hook is constructed with a cam at the back to prevent the lever being bent back out of shape. This hook is apparently a very desirable article.

GEORGE M. MAYER, 79 Fifth avenue, Chicago, Ill., calls attention to the line of single and double pole-action spring jacks and plugs. He also carries a complete assortment of telephone switchboard supplies.

THE AMERICAN PEGAMOID COMPANY, 346 Broadway, New York City, advertise the "Pegamoid Bright Metal Protector." This is a colorles liquid easily applied by a brush and dries rapidly without brush marks. It leaves a colorless, invisible, strongly adhering film protecting the surface of the metal against rust and corrosion. It is especially applicable for steel parts of machinery, nickel plate, bicycles, etc.

THE VICTOR CIRCUIT BREAKERS are advertised at reasonable prices by F. A. La Roche & Co., Thirteenth and Hudson streets, New York City.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., have a word to say about the construction of their switchboards. They present an illustration showing the type of clean-cut open work which they have adapted, including all their parts.

JAMES C. WORMLEY & CO., 702 Marquette Building, Chicago, Ill., are making special inducements to one dealer in each city to sell their lamps. They guarantee them to be satisfactory and jobbers may find it worth while to obtain the details of the offer.

WILBUR B. DRIVER & CO., 126 Liberty street, New York City, are the sole agents for Roebling's climax resistance wire. The special features of this wire were noted in our issue of last week.

NEW YORK TELEPHONE COMPANY, 15 Dey street, New York City, note a great convenience of telephone service in private residences and offer service at very moderate cost.

THE RASTER CARBON RHEOSTAT COMPANY, 231 South Canal street, Chicago, Ill., say that besides having a good reputation their manufactures have quality to back it up. They make everything in the rheostat line, including elevator controllers, pump controllers, automatic motor starters, dimmers, field and motor regulators, etc.

WESTERN NOTES

MINNEAPOLIS. The city council in order to force lower rates on the local General Electric Co., is threatening to put in a plant is its own.

RIVER FALLS, WIS. The State Normal School at River Walls, Wis., has been equipped with a complete telephone and electric programme clock system. The work was done by the Julius Andrae & Sons Co., of Milwaukee, and is said to be perfectly arranged. The programme clock works automatically, announcing the exact time of new studies for the various classes, as well as indicating the department in which they will be held. In the superintendent's office is found a switchboard which enables him to communicate with any department of the large school without leaving his desk.

THE ANDRAE PEOPLE have prepared a sign which smacks somewhat of the original. It is posted on the buildings in which the company does the electrical work, and bears the following words: "The electrical work in this building is perfect. Andrae did it."

CHICAGO RHEOSTAT CO. have opened a fine suite of offices, 1649-1650 Marquette Building, Chicago. The company's

Digitized by Google

general manager is E. W. Hammer, formerly of the Cutler-Hammer Co. They manufacture a complete line of magnetic release motor starters and overload release motor starters, solenoid pump starters, non-magnetic pump starters, elevator starters, etc.

THE CENTRAL ELECTRIC CO., of Chicago, in addition to their regular large stock of all kinds of standard and special telephone wires, are carrying full stocks in all sizes of special tinned annunciator wire for telephone switchboard work.

FORT WAYNE ELECTRIC CORPORATION have moved their New Orleans office from 145 Carondelet street to Room 717, Hennen Building.

CRAIN'S PARHELION LAMPS. The John Shillito Company, Cincinnati, O., are installing 200 Crain parhelion arcs, after a severe test sustaining the claims as to simplicity, regulation, interchangeability, etc. Mr. George H. Stout, 1208 Sheffield avenue, Chicago, is the general sales agent.

CASS & AARON, dealers in second-hand apparatus and operating a repair shop, report business as excellent. They have recently added to their equipment considerable new machinery, and for a concern six months old they have made a most remarkable showing.

VICTOR TELEPHONE MFG. CO., Chicago, reports shipping last week a 200 exchange equipment to Mitchell, S. D., consisting of switchboard, telephones, lightning arresters, cross connection boards, etc. Another exchange equipment is now going through their factory for Paxton, Ill., of 200 capacity, and a board of 400 drop capacity is also building for Champlain, Ill. A large amount of other telephone work is in progress for early delivery, and the company's books teem with orders.

MYSENBERG & BADT, handling the Badt's hermetic cell, state that this battery has met with instant success.

J. C. WORMLEY, Marquette Building, Chicago. The demand for the Wormley lamp this fall has exceeded his expectations.

NEW ENGLAND NOTES

THE ELECTRIC GAS LIGHTING COMPANY, of Boston, have recently increased the floor space of their factory 50 per cent., made necessary by the rapidly increasing sales of their varied line of electric gas lighting open-circuit battery and house goods specialties.

NEW YORK NOTES.

ZIMDARS & HUNT, 127 Fifth avenue, New York, report a heavy demand for their general catalogue, recently issued. Among the features that makes it exceptionally valuable are the complete illustrations, lists of sizes and prices, and general information regarding panel and feeder boards that it contains. Only their foresight in providing an extra large edition has enabled them to keep up with the demand.

MR. GEORG KIRKEGAARD, who recently compiled a handy data sheet for mechanics and draughtsmen, reports that the sale has been beyond his expectations, and that he finds it necessary to print a second edition. Mr. Kirkegaard has recently started a business on his own account at 61 Fulton street, where he has established a shop for the manufacture of all kinds of electrical and mechanical apparatus.

MR. LEO. T. LEVY, well known in the trade as the New York representative of the Chicago Fuse Wire and Manufacturing Company, Chicago, with offices at 853 Broadway, New York, has just made arrangements with the Wheeler Reflector Company, of Boston, to act as their sole New York representative. On the strength of the great popularity and extensive introduction of these well-known products and his own large acquaintance in the trade, Mr. Levy confidently expects to serve with promptness and to their satisfaction everyone in need of fuse wires and reflectors. He guarantees prompt delivery of all sales.

ATWOOD POWER AND SPEED GAGE CO. has been formed to manufacture and sell the gage recently illustrated and described in The Electrical Engineer. The incorporators are G. F. Atwood, H. A. Fields and G. R. Swain. The capital stock is $75,000, and the headquarters are at 763 Broad street, Newark, N. J.

FOREIGN NOTES

A VISIT is being paid to this country by Mr. S. Jevons, managing director of the Gem Dynamo Brush Company, Limited, of Birmingham, England. He is here with the intention of placing upon the American market the "Sparkless Gem" dynamo and motor brush. This brush is entirely new, and is claimed to be superior in all practical points. It is formed of fine crimped copper wires bundled together and encased in gauze covering, and can be made heavy or light, firm or flexible, as may be desired. The advantages gained are the soft contact surface on the commutator, long durability, high conductivity and low temperature, ensuring a brush efficiency of the best and minimizing the tendency to sparking. Mr. Jevons is staying in New York at the Westminster Hotel, Irving Place, for a short period, during which he will be pleased to meet all who wish to become acquainted with this fully patented invention and to receive proposals from those competent to handle a large business such as is already firmly established in Great Britain and on the continent of Europe.

CONTENTS.

EDITORIALS:
The Lowering Price of Current 362
The Charging of Storage Cells 362
The Prejudice Against Machinery 363
Everybody an Office-Holder 363
Electrical Refrigeration 363
MISCELLANEOUS:
Electrical Refrigeration—II. (illustr.) ..... Thomas J. Fay. 353
Apparatus for Measuring Coefficients of Self-Induction ..... S. T. Morland. 354
ELECTRIC LIGHTING:
Wiring the New York State Capitol (illustr.) 355
The Lieb Park Lamp Post (illustr.).—Reduction of the Price of Current by the New York Edison Co. 357
Incandescent Lamps as Manufactured by the Shelby Electric Co., Shelby, O. (illustr.) 358
PERSONAL:
Mr. J. W. McDonough.—Purdue University 361
LITERATURE:
Grawinkel and Streckens "Hilfsbuch Für Die Elektrotechnik" 363
Fischer's "Elektrische Licht-und Kraft-Anlagen" 363
MUNICIPAL AFFAIRS:
Some Views and Data on Municipal Ownership—I. . Henry Hopkins. 364
TELEPHONY AND TELEGRAPHY:
The New Telephone Exchange at Worcester, Mass. (illustr.) 364
The "Morse-Watch:" A Secret Telegraph Sounder (illustr.) 365
The Victor Express Switchboard (illustr.) 366
A New Telegraph Line for Cuba.—Large Output of Bell Telephones 367
ROENTGEN RAYS:
Specifications Concerning Röntgen Rays .... Francke L. Woodward. 367
ELECTRIC TRANSPORTATION:
A Study of the Storage Battery Performonce on the South Side Elevated Railroad of Chicago (illustr.) 368
Track Construction, Its Present Defects and Its Remedy (illustr.) .. Thomas H. Gibbon, C. E. 370
To What Extent Should Street Railways Engage in the Amusement Business ..... Walton H. Holmes. 371
POWER TRANSMISSION:
Calcium Carbide Works, Niagara (illustr.) 371
NEWS AND NOTES:
The Caracas Warehouse: A Boon to American Manufacturers 372
INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Oct. 4, 1898 ... 372
REPORTS OF COMPANIES:
The New York Gas and Electric Light, Heat and Power Co.—New Orleans Traction Reorganization 373
SOCIETY AND CLUB NOTES:
Journal of the Association of Engineering Societies 373
LEGAL NOTES:
Taxation of Electrical Patents as Property 373
THE STOCK MARKET:
The Public Too Busy to Speculate 373
TRADE NOTES AND NOVELTIES:
The Sturtevant Electrically Driven Fan (illustr.).—The General Electric Co., of England.—Popularity of Montauk Multiphase Cables.—Goubert Mfg. Co.—New Bogart Electric Gas Lighting Burner (illustr.) 374
The Garvin Machine Co.—Manila Rope.—Fort Wayne School of Electricity.—Advertisers' Hints.—Western Notes 375
New England Notes.—New York Notes.—Foreign Notes 376

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. OCTOBER 20, 1898. No. 546.

Colorado Electric Power Co.'s Station at Canon City.

BY BERT E. WADE.

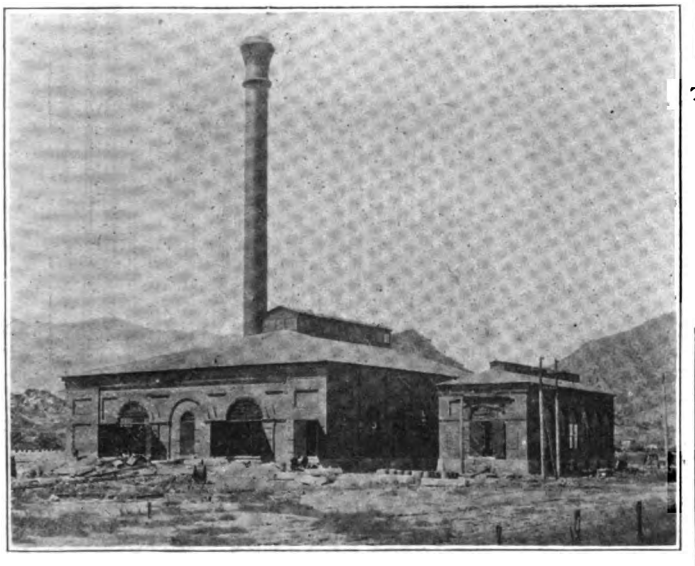
ON the morning of August 16 a party of 400, including mine owners and electricians, gathered at the Denver & Rio Grande station, at Colorado Springs, to take the train for Canon City, being accompanied by the Midland Band.

This excursion was given by D. V. Donaldson, president of the Colorado Electric Power Co., for the purpose of showing the mine owners that they could be supplied with power and light, from a station, at a distance of twenty-four miles from their mines.

The special train took on a number of prominent mining men at Pueblo, arriving at the power house at Canon City at 11:30 a. m. Exactly at noon Gov. Adams stepped forward to the switchboard in the generator room and pulled down a lever which set the machinery in motion.

THE POWER HOUSE.

Already $250,000 has been expended upon this plant, and half as much again will be put out before the equipment is



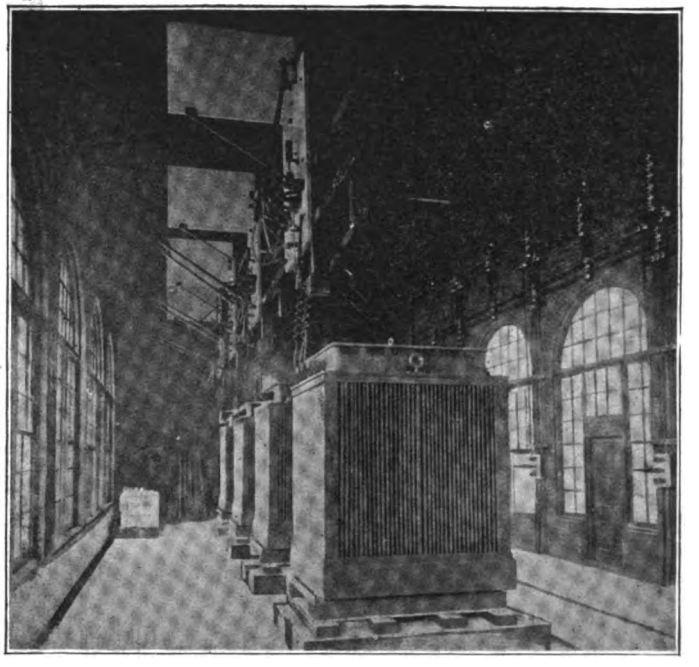
POWER AND TRANSFORMER HOUSES, COLORADO POWER CO., CANON CITY, COLO.

complete, in the Cripple Creek end of the line. The plant is a model of its kind, and is without an equal in point of completeness in this country.

The Colorado Electric Power Co.'s plant is located in a substantial structure, 140 by 106 feet, built of stone, brick and steel, and is, consequently, fireproof. The west end of the building is put in temporarily, so that the plant may be extended at any time.

In this building are the boilers, three immense Hamilton-Corliss engines, with three large Westinghouse alternating current generators, adapted for operating the Tesla three-phase system, which is the system of transmission used. Each machine has it armature mounted on the shaft of a Hamilton-Corliss compound-condensing engine, and the combination of engine and dynamo forms a generating unit. There are three of these units at present, one of which will always be kept idle as a reserve in case of emergency.

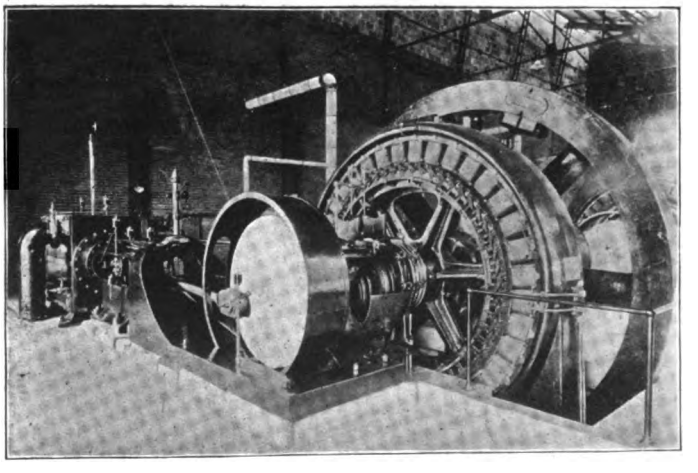
For exciting fields for the main dynamos there is a "Kodak" exciter outfit which is capable of exciting all three of the main dynamos. A rotary transformer is ordinarily used for exciting, the Kodak being a reserve. The engines are all supplied from a battery of Heine water tube boilers, and the exhaust steam from the engines driving the main dynamos is taken care of in a sur-



TRANSFORMERS, COLORADO POWER CO., CANON CITY, CAL.

face condenser. The air and circulating pumps and feed pumps are all of the Snow make. The electric and steam machinery is capable of supplying 2,000 h. p.

From the main dynamos the current is taken to the switchboard, hence it is distributed to the raising transformers, of which there are four, three in service and one reserve. Here the current is transformed from the 500 volts delivered by the dyna-



GENERATING UNIT, COLORADO POWER CO., CANON CITY, COLORADO.

mos to 20,000 volts, at which pressure it is delivered to the transmission line.

DISTRIBUTING THE POWER.

The first distributing station is near Victor, on the saddle between Battle Mountain and Bull Hill. The location of the second sub-station is on the saddle between Globe Hill and Gold Hill, near Cripple Creek. At the sub-station the current is again transformed, but this time from 20,000 volts back to 500

Digitized by Google

volts, at which pressure it is delivered to the mines for all uses, both light and power.

One of the principal points kept in view in the construction of this plant is that of insuring continuous service. The machinery and construction are the very best, and reserve capacity is carried throughout.

The construction of the transmission line is most substantial; particular pains have been taken to protect it from lightning troubles. In addition to the lightning arresters in the generating station at Canon City and in the sub-stations lightning arresters have been installed at a number of points along the transmission line.

It should be added that, in addition to the twenty-five miles between Canon City and Cripple Creek there is about six miles of line over the camp, which will make the total length of line thirty miles. It took nearly twelve months to complete the plant ready for work.

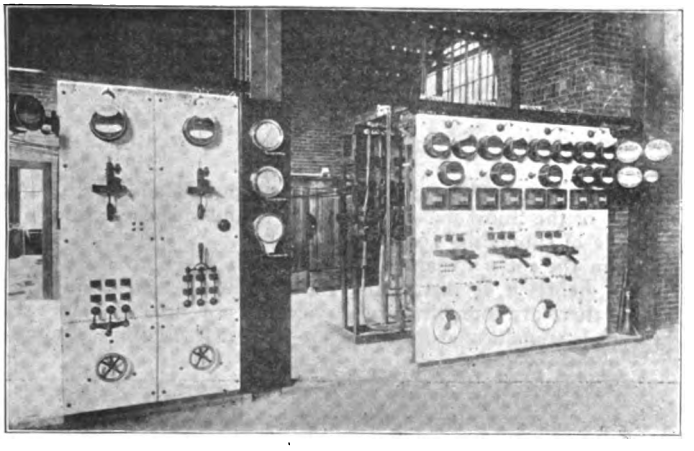
GUARDING THE MAIN LINE.

The entire line is patrolled by experienced linemen, who are literally walking telephones. They carry with them little telephones, which they can connect with the line at any point and send in word wherever they find a break.

Western Union call boxes are stationed along the line, and through them the patrolman must send in a signal where he is every hour. These calls are registered at the stations at each end of the line.

THE ESTIMATED ECONOMY.

It has been carefully computed that there will be a saving of 25 per cent. in the running expenses of the mines if electricity is used, in so far as the matter of hoisting the ore, running drills and doing whatever steam can do is concerned. Then, again,



SWITCHBOARD, COLORADO POWER CO, CANON CITY, CAL.

there can be no argument brought against the convenience. Will there be no breakdowns? The experiences of the plant of the Central California Power Co., at Sacramento, are typical in this regard. In that instance during the two years that the plant has been in operation there have been but three stops, two for five minutes and one for twenty minutes; in all, thirty minutes.

There is one phase of the question that is to be remarked upon by the bringing of electricity into the camps of many of the smaller properties now being worked by horses. These will now be furnished with a cheap motive power that will render the use of horse power dear in comparison; that is, when the amount of work that can be accomplished with the new power is considered. This is bound to result in the developing of many small properties that have been worked indifferently heretofore. Power will be rented out to these prospectors at definite schedules, so that each one knows before he starts just how much it will cost him for his month's work. If at the end of the month he finds that it does not pay, then the little motor can be taken out and operations transferred to another locality.

But, with the large mines, all that need be said is that everything that is being done now with steam will be done hereafter by electricity. Among the mines that will supplant steam with the new power are the Lillie, the Taylor and Brunton, Sampler, the Wisconsin group, owned by the Morses; the Jack Pot, Work, Mary Anne, the Moon-Anchor and others.

The Portland, the Hull City placer mine and other large properties are figuring on power, and as soon as favorable terms can be negotiated steam will be abandoned in these mines and electricity substituted. The building was erected by Canon City constructors. The boilers, engines, pumps, etc., are by Stearn & Rogers, of Denver; all electrical machinery was furnished by the Westinghouse Company, and the pole line by the Mountain Electric Company, of Denver.

The officers of the company are: President and general manager, D. V. Donaldson; J. R. McKinney, vice-president; Walter Scott, secretary; J. A. Hayes, treasurer; R. H. Sterling, superintendent; R. D. Mershon, chief engineer; directors, D. V. Donaldson, J. R. McKinnie, Walter Scott, J. A. Hayes, H. G. Lunt, all of Colorado Springs; John G. Holmes, Pittsburg, and J. G. White, New York City.

MISCELLANEOUS

Electrical Refrigeration.—III.

(Concluded.)

BY THOMAS J. FAY.

THE auxiliary equipment as required with the compressor and motor in refrigerating work, as hereinbefore referred to, includes condensers, oil separators, liquid receivers,

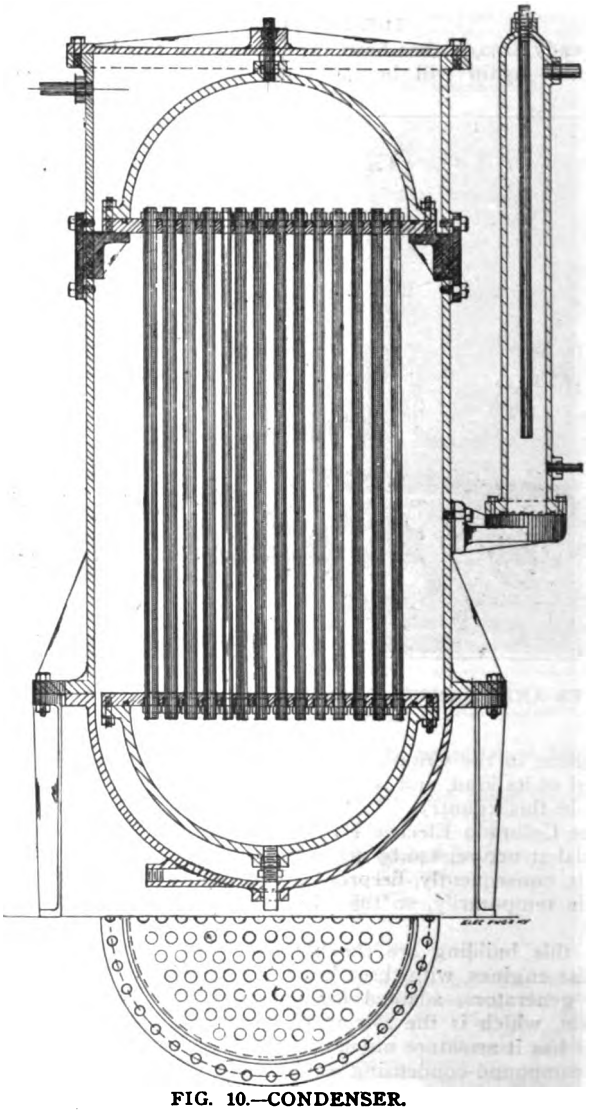
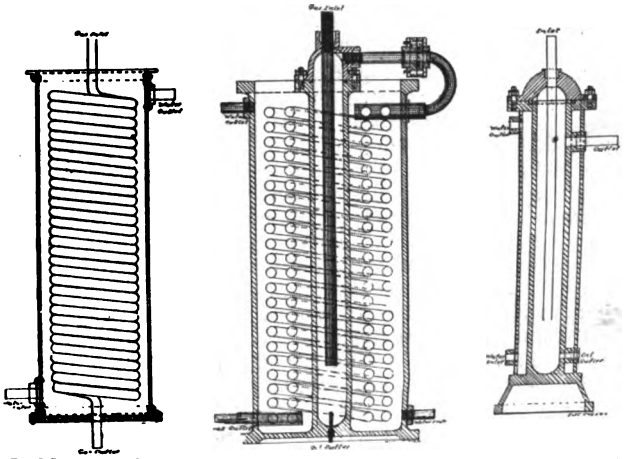


FIG. 10.—CONDENSER.

valves, pipings, etc., thereby facilitating and completing the operations. Fig. 8 is of a condenser of the ordinary pat-

Digitized by Google

tern. Then we have Fig. 9, representing a condenser and oil separator combined, neither of which will need further description here. Fig. 10, however, is a straight tube condenser, more efficient perhaps than the coil tube types, certainly more easily



FIGS. 8, 9 AND 13.—CONDENSERS AND OIL SEPARATORS.

cleaned. Fig. 11, a brine cooler, is not different from the condenser, Fig. 10, only in so much as it is insulated outside, thereby to prevent a transfer of heat units to its surrounding, which in-

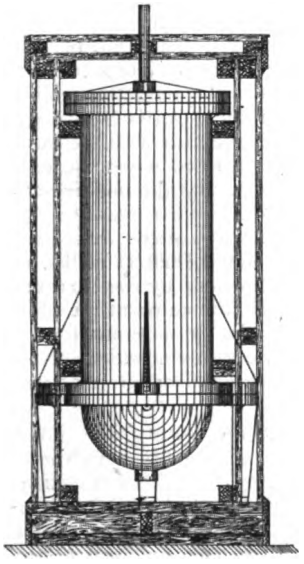


FIG. 11.—BRINE COOLER.

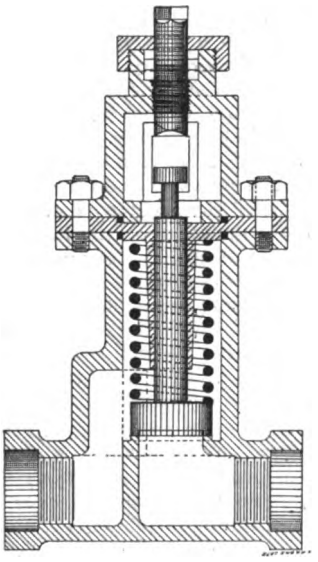


FIG. 14.—COMBINATION CHECK AND HAND VALVE.

sulation is not necessary when the apparatus is used as a condenser, because the condenser is at the temperature of condensing water, which is at or near that of the surrounding. Fig. 12

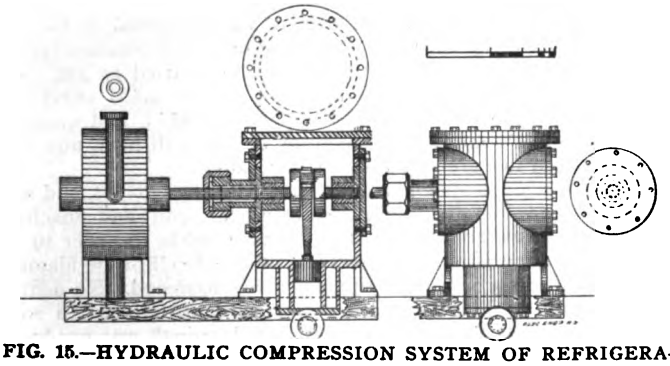


FIG. 15.—HYDRAULIC COMPRESSION SYSTEM OF REFRIGERATION.

is that of a valve motion available for this class of work and reperesents a very compact combination of suction and discharge under one housing. Fig. 13 is of an oil separator, water-jacketed that heat might be extracted from the compressed gas during the process of oil separation. Fig. 14 shows a combination check and hand valve suggested by the writer for this class of

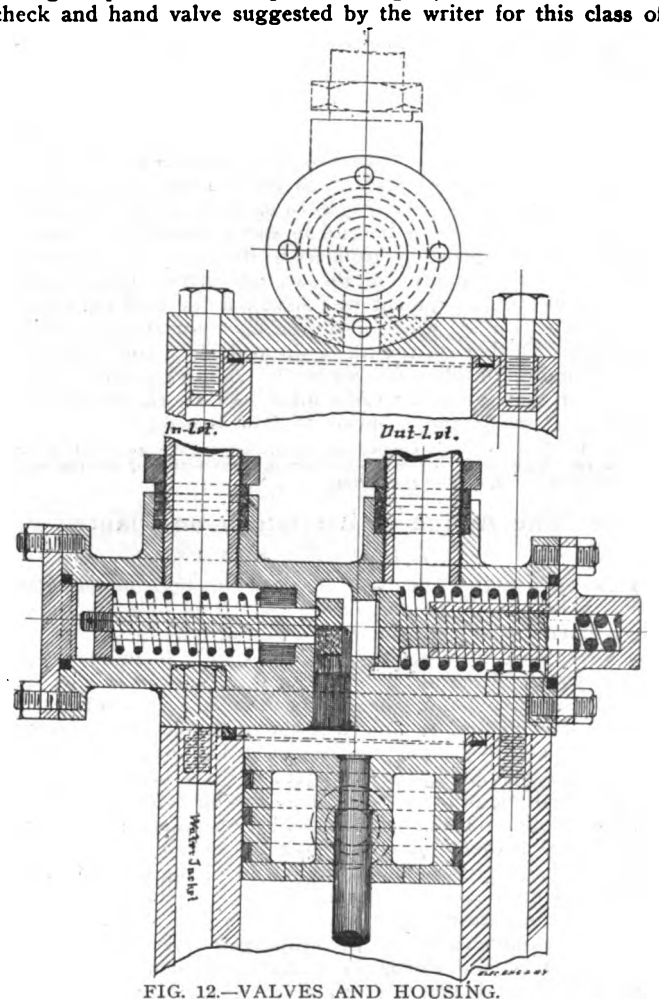


FIG. 12.—VALVES AND HOUSING.

work. Fig. 15 represents an hydraulic compressor, which would cost excessively to operate at the usual price for water, and might well be consigned to the same basket as most other watered stock. There are others, but space will not permit.

THE COST OF REFRIGERATION

Depends largely, in fact almost wholly, upon the cost of electrical energy, when reference is had to the system of the subject and as respects the cost of current. Enough is to say it varies in different localities. For the sake of striking an average however, and allowing that a good rate would be made, users of this class of apparatus, for reasons herein before stated; then let it be

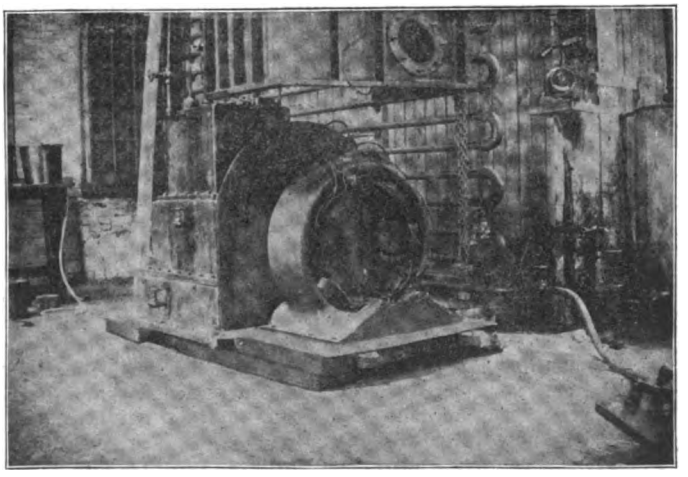


FIG. 16.—DIRECT CONNECTED COMPRESSOR.

assumed that 5 cents per kilowatt will suffice for the purpose, and again, to average, it will be fair to say 1 kilowatt per hour for

Digitized by Google

twenty-four hours will effect the equivalent of one ton of ice melted. Therefore, to sum up:

24 kilowatt hours @ .05	$1.20
1,440 gallons water	.15
Oil, etc., inspections, etc.	.15
Total	$1.50

As comparison, it is enough to call attention to rates for ice, viz., contract for three years at $4 per ton for large consumers, whereas small users of ice pay even as much as $20 per ton, and the range of prices may be said to stand somewhere between 10 cents a look for private consumers to the price above quoted for large consumers, and it is on this account that sooner or later automatic electric equipment will drive out the cold effrontery of the peddlers of ice whose pedigree may not stand a close inspection. Do I mean the ice or the peddler? Oh, I mean both the ice and the peddler, for, while one contains germs of disease, the other contains dangers of a more subtle sort, which involves political economy and is out of its element here.

Fig. 16 shows a direct connected compresor, with a gas-tight cover for motor raised above it, the armature having been removed for the purpose of changing the speed by rewinding.

The Action of Electricity on Plants[1]

BY E. H. COOK, D. Sc., F. I. C.

THE destructive effects of electricity of high potential upon plants needs no demonstration. It is only necessary to remember the wrecks which are made of our finest forest trees by a single flash of lightning to call vividly to mind the enormous power of the discharge. But the action of smaller quantities at lower potentials has not been extensively studied. True it is that from time to time we hear of wonderful results being obtained, and marvelous experiments being made. In many of these cases, undoubtedly, exaggeration has been indulged in, and the attitude of the scientific man has become very much that of the skeptic. This is unfortunate, because there is undoubtedly something in the subject, although the unraveling of the facts is surrounded by peculiar difficulties, involving complicated and extremely prolonged experimentation.

For some considerable time the idea that electricity might have some influence on the growth of plants seems to have been simmering in the minds of many experimenters. Thus, in 1806, the great botanist, de Candolle, experimented for a long time, but without arriving at definite results. Other experimenters also tried, but no results seem to have been obtained until Naudin used means for supplying electricity from an external source to the soil in which the plants were growing. He claims to have obtained increased effects. The experiments of Sir William Siemens with the electric light are well known, but some of the most important have been made in Russia by M. Spechnew, and in France by several agriculturists, of whom, perhaps, M. Barrat and M. Paulin may be mentioned. In these cases the experiments have been made on the large scale, and have extended over many years.

The experiments recorded in this paper were commenced so far back as 1886. They have been repeated many times as the conditions affecting the results gradually became known. They may be considered under three heads: (1) Those relating to the germination of seeds. (2) Those relating to the growing of plants in soil. (3) Those dealing with the lower forms of plant life such as algæ, fungi, etc.

1. Influence on the Germination of Seeds.—Numerous experiments were made in order to see if any effects could be obtained with constant or intermittent currents and with high or low tension electricity. Taking one mode of experimenting as a type of the whole, a current of electricity varying from 1 to 10 milliamperes was passed by means of carbon plates through moistened grains either of barley, wheat, peas, or other seeds contained in beakers. Side by side with these were placed similar seeds through which no current was passed. The current was switched on for about two hours daily. The results were sometimes indefinite, sometimes extraordinarily successful, but the general effect was to give an increased development in the electric seeds amounting to from 10 to 20 per cent. more than in the non-electrified ones.

Experiments were also made with a view of discovering whether constant or intermittent currents were best suited to accelerate the growth. It was found that no advantage could be obtained by constant currents over intermittent ones, and in some cases the constant current was not beneficial.

High tension electricity was tried by subjecting the seeds to electrification from a Wimshurst machine inside glass vessels before planting. The results obtained showed that in this way a larger proportion of seeds germinated, but the electrified show no increased growth over the non-electrified.

2. Influence on Growing Plants.—The experiments on seeds showed that with a suitable amount of electricity at a suitable e. m. f. the germination was accelerated; it then became necessary to determine whether, after the plant was formed, any increase in the rate of the processes of assimilation and absorption took place. For this purpose experiments were tried with seeds planted in similar soil and in similar pots. Through some of these a current was sent between carbon electrodes, while the others were allowed to grow in an ordinary manner. Experiments were tried with intermittent and continuous currents, and with a variety of seeds. In almost every case the electrically urged plants came to maturity first, but they were also the first to show above the soil, and I could not satisfy myself that, with the currents employed, viz., from 1 to 30 milliamperes and with an e. m. f. of 5 to 25 volts, that any increased rate of growth was observable after the cotyledons appeared above the soil. In other words, an electrically urged plant grown from seed in soil will show above the soil, say, four days before one not so urged; but after that the electrically urged plant will maintain its four days' start throughout—it will not gain after the first start. Therefore, practically, in growing plants in this way, no advantage is obtained by continuing the application of the electricity after the first appearance of the green leaves. This, of course, applies to electricity of low e. m. f.

Experiments were now tried to find if the same peculiarity held for electricity of high e. m. f. For this purpose the discharges from the Wimshurst and from the induction coil were employed. Moreover, the effects of the positive and negative were tried separately. The results showed that with the machine a much increased rate of growth is obtained when the e. m. f. varies from 25 to 40,000 volts; moreover, that the positive always produced the greater effect at first, but that the negative rapidly caught up and took the lead. It was also noticed that with this kind of electricity certain kinds of plants, such as bulbs, could be accelerated which could not be influenced by the current. In one of these experiments on hyacinths, the color of the blossom produced under the negative was distinctly different to that of the positive, as well as to that of the non-electrified. Possibly this may be caused by the larger amount of ozone produced by the negative discharge.

In order to compare the effects of the battery, the induction coil, and the machine, experiments were made with the same seeds grown, (1) without any electricity, (2) with a current passing between carbon electrodes, (3) under the positive point from a Wimshurst machine, (4) under the negative from the same, (5) under the positive point of an induction coil, and (6) under the negative point of an induction coil. In every case the positive end of the coil produced the greatest effect. This was with an e. m. f. of approximately 45,000 volts.

Experiments with Low Forms of Plant Life.—Experiments have been made with yeast, spirogyra, and other large celled fresh water algæ.

With yeast the rate of development was measured by the rate of evolution of the carbon dioxide. With this substance (yeast) only the current from the battery has been tried as yet. The results were somewhat indefinite, but an increased effect was produced within a very limited range of e. m. f. and quantity. The complete conditions regulating the growth have not been fully studied but are still under examination.

The effect upon spirogyra was tried with the current, and with positive and negative spraying from the coil and machine. Microscopic examination was continually made in order to see if any alteration could be observed in the end cell of the filament, and also if the process of conjugation was hastened. No definite conclusions could be reached in reference to either. In some instances it was thought that accelerated growth was produced, but repetition of the experiments failed to confirm the results.

In the case of the current, electrolytic effects took place, gases being evolved from the platinum electrodes.

Great care had to be taken in the spraying with the electricity from the machine, because the fibers of the plants were found to be readily broken up at the junction of the cells, and it was

[1]Abstract of paper read before the Brit. Assoc.

Digitized by Google

difficult when this occurred to judge of the change in growth of the fibers. It is intended to continue these experiments.

Application on the Large Scale.—Experiments have been made by M. Barratt and M. Spechnew by connecting large plates of copper and zinc sunk in the soil with a wire, and growing plants between, and also by connecting plates to a battery. It is, however, evident that if atmospheric electricity could be employed, a practically unlimited source is available. Beckeinstener was the first to try this. Following him, several experimenters in France and other countries have invented, perfected, and used what has been called the "Géomagnétifère," with remarkable results. The instrument is practically a lightning conductor set up in the middle of a field, and connected below with a series of cross wires running under the soil near the roots of the plants.

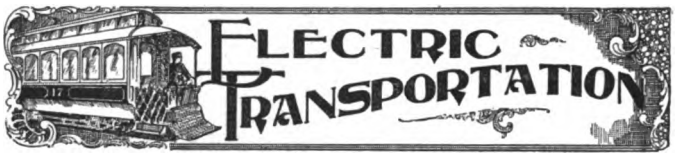
The results obtained with this instrument are remarkable. Thus to quote two well-authenticated experiments: A "Geo." was set up in a field adjoining the main road from Montbrison to Montroud, of 8.5 metres high, and made its influence felt over a circular area of 20 metres radius. Within this area was marked out two squares of 4 metres side, and the potatoes growing in these patches were compared with those growing in two equal-size patches in another portion of the same field. The potatoes grown in the two squares within the area weighed 90 kilos; those grown outside weighed 61 kilos. The number of plants were practically equal. Again, in another case, 60 potato plants grown near the wires of a "Geo." gave 63 kilos, 100 grammes of tubers, whereas 60 plants grown in the same field, but away from the "Geo.," gave only 35 kilos. This gives a difference in the money value of about £8 16s. per acre. Both these experiments are well authenticated. In view of these results it was determined to make a trial in Clifton. Accordingly, in the early spring, M. Pinot de Moira, who is an excellent amateur gardener, as well as a scientist, was induced to put up a "Geo." in his garden on Clifton Hill. Potatoes, beans, tomatoes, peas, etc., were grown near the wires and in other parts of the garden. A distinctly increased effect was observed in all cases near the wire, thus confirming in some measure the results of the French experimenters. The crop of tomatoes is remarkable; on some plants the number of fruits is between 90 and 100, all well developed. For plants growing in the open air this is remarkable. Unfortunately, it was impracticable to grow unelectrified tomato plants to compare with these under similar conditions. It is, however, much to be desired that further and continuous experiments should be carried out.

Theories to Account for the Action.—Before attempting any theorizing, it was thought advisable to thoroughly establish the facts. Much time has, therefore, not been given to the testing of supposed explanations. One of the first ideas would be, that the rise in temperature would, perhaps, cause the effect. Very delicate thermometers plunged in the soil showed no rise in temperature; moreover, it can be calculated that, with the strongest currents employed, the rise in temperature would not exceed 1-500th of a degree per hour, an amount too small to produce the effects noted.

Another theory which has been proposed by Spechnew is, that a proces somewhat like electrolysis goes on in the soil whereby the nutrient material is broken up into compounds which are more readily absorbed by the roots of the plants. In support of this, he cites several experiments which he has made. In confirmation in experiments made to test this, I found in the neighborhood of the positive electrode the earth was slightly acid, whereas that near the negative was faintly alkaline, thus proving the existence of an electrolytic action. But obviously this explanation will not account for many of the effects, and, in fact, the subject is so wide, that many different actions are probably at work, and it will be necessary to multiply the experiments, and to know more of the conditions, before satisfactory explanations can be given. As a step in this direction, the experiments recorded in this paper are considered to show that a particular plant requires for its maximum development a distinct strength of current and of a definite potential.

Novel Method of Determining the Frequency of Alternating Currents.

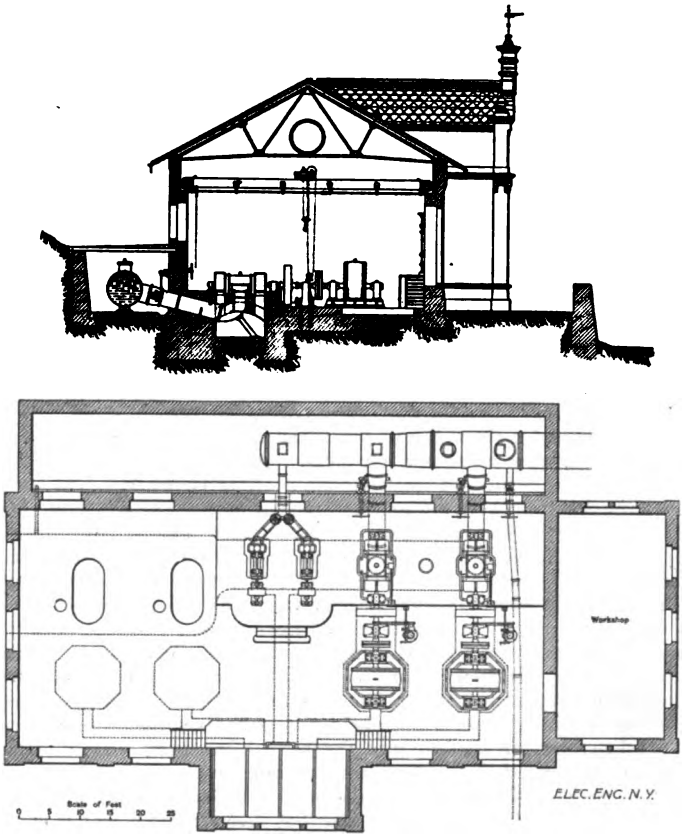
Mr. C. Kinsley, in an article appearing in the Phil. Mag., April, 1898, proposes a novel method of determining the frequency of an alternating current. The apparatus consists of a telephone and an air column of adjustable length, contained in a tube of drawn brass provided with a closely-fitting piston. The telephone receiver is inserted in the alternate current circuit, and the tube is placed in front of it at a distance of about half the diameter of the tube. The telephone not only gives a note corresponding to the frequency of the alternating current, but also to a number of "harmonics," and for all these notes there will be a reinforcement of sound when the air column attains a certain length. But in any case the frequency of the fundamental is the greatest common divisor of the frequencies of successive harmonics, so that it is easy to discriminate between them. Before arriving at the final result corrections have to be made for temperature and for the diameter of the tube (add 0.41 d to the length). For these corrections tables are given. The author finds drawn brass tubes 4 cm. in diameter most durable and convenient. He also finds that the natural period of the diaphragm in every telephone on the market is too high to affect in any sensible way the harmonics due to the alternating current.



The Jungfrau Railway Power Plant.

ON Monday, Sept. 19, the first section of the Jungfrau Electric Railway was opened. The details of this interesting "trolley to heaven" have from time to time been illustrated in these columns[1], and we are now able to describe and illustrate the power house, located at Lauterbrunnen, being indebted to the "London Electrician" for the details.

The power plant at Lauterbrunnen will, when completed, utilize about 1,320 gallons of water per second from the White



SECTIONAL ELEVATION AND PLAN OF POWER HOUSE, JUNGFRAU RAILWAY.

Lütschine, with a head of 125 feet, of which 115 feet is utilized at the turbines. The river is swollen in the summer by the melting snow and glaciers from the mountains, and thus at the

[1]The Electrical Engineer, Nov. 18, 1896; Sept. 23, 1897, and Feb. 24, 1898.

Digitized by Google

time when the greatest power is needed the most is available. A steel pipe line about 1,500 yards long serves as a head-race. It taps the river a little below the famous Staubbach waterfall, just above the railway bridge of the Wengern Alp Railway. The pipes have an internal diameter of 5 feet 11 inches. About half of the conduit is nearly horizontal, with a fall of only about

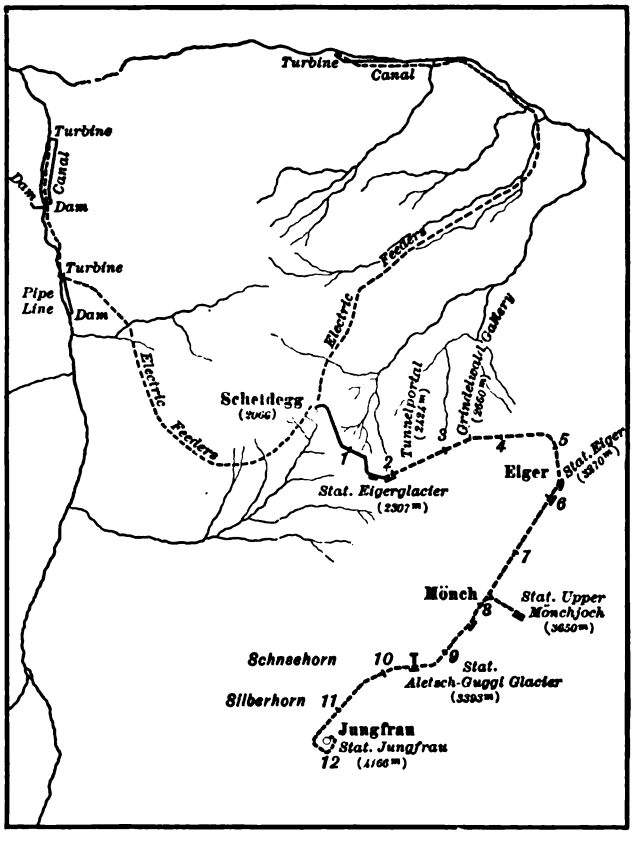


FIG. 3.—MAP OF JUNGFRAU ROAD AND ITS SOURCES OF POWER IN THE WHITE AND BLACK LUETSCHINE RIVERS.

0.3 per cent.; this section of the pipe has a thickness of 0.197 inches, and is made in lengths of 19 feet 8 inches. Between this and the lower half of the pipe-line a vertical pipe is attached to avoid shocks and to insure a smooth flow of water. The remainder of the line is of stouter pipe, 0.236 inches and 0.276 inches thick, the internal diameter being the same, and it is made in 24-foot lengths. The power house is on the right bank of the river, and the pipe-line has to cross from the left bank over an iron bridge built especially for the purpose. The upper part of the pipe line is buried, the lower part uncovered.

Figs. 1 and 2 show the power-house in sectional elevation and plan. Fig. 3 is from Mr. Guyer Zeller's original drawings and plans of the road and its environment. It is proposed to have eventually four generating sets, each of 500 h. p. capacity, but only two have been put down to start with. The turbines, made by Messrs. J. J. Rieter & Co., who were the contractors for all the hydraulic work, are of the twin Girard type, with axial flow. They work with 115-foot head and a flow of 314 gallons of water per second at full load, making 380 revolutions per minute, the speed being controlled by Messrs. Rieter's automatic governors. The generators, of the Oerlikon inductor type, are directly coupled to them. The erection of the turbines has been completed, and one of the dynamos is in position. Power for the line and for the work in the tunnel has been derived from a 1,000 h. p. machine temporarily installed. The generators seem to be built on the lines usually followed by the Oerlikon Co. in their inductor type. As has been already mentioned, three-phase current at 7,000 volts and 38 revolutions per second is generated. The exciters are shunt-wound and four-polar, making 700 revolutions per minute, and generating at full load 150 amperes at 120 volts. Their turbines, which are also directly coupled to them, use 15.6 gallons of water per second. The regulation of the voltage is effected by adjusting the resistance in the circuit of the excited fields. The switchboard is on a gallery from which the whole station can be overlooked. In general appearance the station is well designed, light and roomy. The frames of the machines are insulated from the floor instead of being earthed. This appears to constitute a not inconsiderable danger to the personnel, as the distance between the bedplates of the machines and their foundations is only about 2 inches or 2½ inches. The temporary machine running at its full pressure of 7,000 volts was only protected by a wooden balustrade, which it was easy to get over or under; but possibly the arrangements in this respect will be improved when the permanent plant is in running order. A paper has been posted up in the station containing instructions for the treatment of persons stunned by electric shock.

Thompson-Walker Surface Contact Railway.

IN a recent lecture before the B. A. Sect. G entitled "Electric Traction by Surface Contacts," Prof. S. P. Thompson and Mr. Miles Walker gave a description of several methods which had been tried. Among these were such methods as Dr. J. Hopkinson's, Ayrton and Perry's, Pollak and Binswanger's, Diatto's, Lineff's, Wynne's, Johnson-Lundell's and Esmond's, many of which embodied some very clever ideas. After giving a description of a method devised by themselves, the authors continue as follows:

When we review all these different methods, we see that the direct magnetic pick-up systems, with a magnet on the car, while operating with somewhat feeble forces, have a great element of safety, in the fact that the forces cannot operate when the car is not there. The system in which the electromagnet is in the switch itself, on the other hand, can be made to operate with very great forces, but there is a danger (only to be avoided by complicating the system) of those very forces keeping the switch closed when the car is absent.

Now, it is possible to combine the advantages of both methods and to avoid their defects. All that is necessary is to make the magnet of the switch operate by attraction on a piece of iron on the car. When the car is absent the switch cannot be held closed because the magnet has nothing to attract, at the same time it is found possible in practice to obtain very great working forces. Upon this principle the authors have constructed an experimental line near Willesden Junction; the main object being to try the practicability of the system upon curves, crossings, and sudden changes of slope. Out of various designs depending upon the closing of a magnetic circuit by the iron of the car, the arrangement which has so far proved most successful in experiment consists of an iron plunger sliding in a vertical tube. If we take an iron plunger with expanded ends, and surround it by a solenoid of wire, carrying a current, it is possible to choose the size of the heads so that the tendency of the plun-

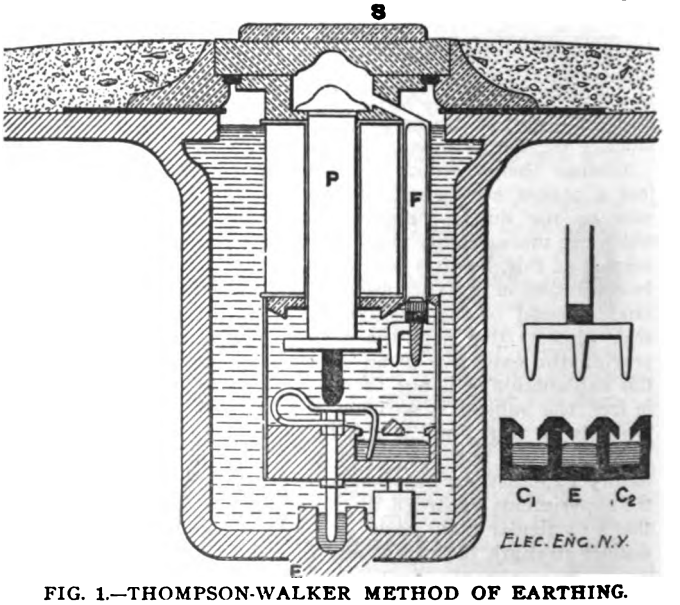


FIG. 1.—THOMPSON-WALKER METHOD OF EARTHING.

ger to assume a central position is balanced by the attraction of the solenoid on the iron heads. With properly chosen heads the solenoid exerts no force whatever on the plunger. Gravity being the only force upon it, it will, of course, take up the position shown. If now, a piece of iron is placed over it, the plun-

Digitized by Google

ger may be raised by the attraction between the two. In case a very heavy plunger is used it is possible to support part of its weight by merely increasing the size of the lower head by a small amount. Thus we have a simple piece of mechanism whose movement is entirely dependent upon the presence of a mass of iron in its neighborhood, and which cannot be moved by the solenoid itself, even though the magnetizing current carries the iron up to the saturation limit. This has been converted into the operating part of the switch. Now, though the force of attraction is sufficient to lift a fairly heavy plunger and operate a switch, it is desirable to have something more than this. We want a switch which will, notwithstanding its massive moving parts, close in an exceedingly short space of time. We want a very great acceleration upon the moving parts during the first part of their motion. This is easily obtained by merely separating the upper head from the plunger by a short air-gap, and arranging matters so that the mass of iron comes over the switch before current is put through the magnetizing coil. As soon as current passes, the attraction upon the head is so great that the plunger gets up a high velocity before the two come together, with the result that the switch operates as though it had been hit with a hammer. A very simple device, a mere film of oil acting as a cushion, can be employed to prevent the switch from being injured by the concussion. The connection of this operating part to the contact points of the switch has been the subject of some very varied experiments. It would be a pity to hamper a part so simple in itself with any gear at all. If the safety of street passengers could be made dependent upon nothing else than the falling of the plunger when the mass of iron is removed, it was thought that as great perfection would be attained as we can hope for from any moving mechanism. The attachment of any gear at once introduces the risk of friction and the simplicity of the plan is destroyed. For that reason, as well as for cheapness and convenience, the method shown in Fig. 1 was decided upon, though there are some simpler modifications of it still under experiment. The diagram, which is merely an incomplete sketch for a lantern slide, shows, in the first place, the cast-iron box which is laid in the street. This is surmounted by a gunmetal stud S, faced with a phosphor-bronze wearing cap. The stud is insulated from the iron box by a sheet of micanite. A non-porous road material is placed around the stud to make up the level.

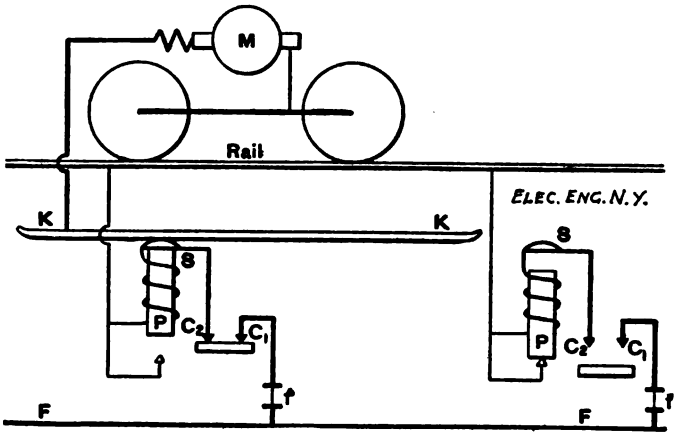


FIG. 2.—THOMPSON-WALKER DIAGRAM OF CONNECTIONS.

The box is filled with oil which, besides performing the function presently to be considered, maintains very high insulation throughout. The switch is attached to the stud and comes away with it in one piece. Being only about 4 inches in diameter no difficulty is found in making a perfectly watertight joint. The next point to consider is the method of making electrical contact. The requirements of switchpoints for disconnecting surface-studs are the following:

When closed the contacts should be of low resistance and capable of carrying 100 amperes easily. They should be incapable of fusing or sticking in any way and should require only a small force to open them. They should retain their shape and efficiency unimpaired for a long time without requiring attention. It will be observed that the current through the stud ceases so soon as the skate parts company with the stud as the car moves forward. Hence in the operation of the car as the switch plunger falls it does not have to break the main current, that having already ceased. Yet although the switches are not required in the ordinary course to break a large current, it is desirable that they should be able in case of accident to do so without injury. After experimenting with different forms of contact it was found that nothing fulfils these requirements so completely as a properly designed mercury contact. Mercury contacts are, therefore, used throughout these switches.

The yoke of copper which dips into the mercury is supported by a brass tube which floats in the oil and fits loosely into a fixed brass tube which acts as a guide. When the plunger rises it takes the oil from under the float, which accordingly falls and connection is made. When the plunger falls the float rises. As the plunger moves quickly the oil has not time to leak past the sides, notwithstanding the very loose fit of the parts and the force upon the yoke piece is very great. At the same time a long movement is obtained.

Safety to the public being the prime consideration, we have kept back our invention until we could be absolutely certain that by no circumstance likely in human probability to arise could the switch be left alive. To operate the switch contacts requires a fraction of an ounce. The forces which operate on the moving plunger (which slides freely in a brass tube in oil) are over 80 pounds at the commencement of the stroke, and are several pounds at the end. The sliding plunger itself weighs 3 pounds. We have, therefore, a margin of safety of many hundred per cent. As the car passes on, there is a breaking of the magnetic and also of the electric circuit, making security doubly sure. And there is yet a third line of defence to the public in that our switch is actually earthed, if when the car passes on the switch fails to open: for then the plunger earths the switch. In that event the fuse would be blown, effectually protecting the public from the possibility of a stud being left alive in the roadway.

It will be seen from the diagram that three cups are employed, the two outer being connected to the main and the stud respectively. The main cup is enclosed in a metal sheath (not shown) permanently connected to earth, so that it is impossible for current to reach the stud except when the yoke is down. Now it will be seen from Fig. 1 that when the plunger is down it earths the centre cup, so that if from any accident whatever the yoke piece fails to open the switch after a car has gone past, the plunger puts the stud to earth and blows the fuse between it and the main. It is not necessary to have any special mode of connecting up the switch boxes. Either shunt or series coils may be used. In practice we prefer a shunt coil because the slightly increased expense is more than compensated for by the smallness of the bulk. Our connections are shown diagrammatically in Fig. 2, which sufficiently explains itself. Only one skate is employed and this is in the centre of the car. This gives much greater facility in going round curves than where two skates and two rows of studs are necessary.

Three-Phase Railway at Evian-les-Bains.

THIS railway, the first one using this system installed in France, was inaugurated July 10, at Evian-les-Bains. Although established for a special purpose, and notwithstanding its short line, the unevenness of the ground, the inclines and curves, and even the nature of the installation presenting difficulties of an entirely new nature, the house of Lombard-Gerin & Co., and Ganz, of Buda-Pesth, have achieved a creditable piece of work.

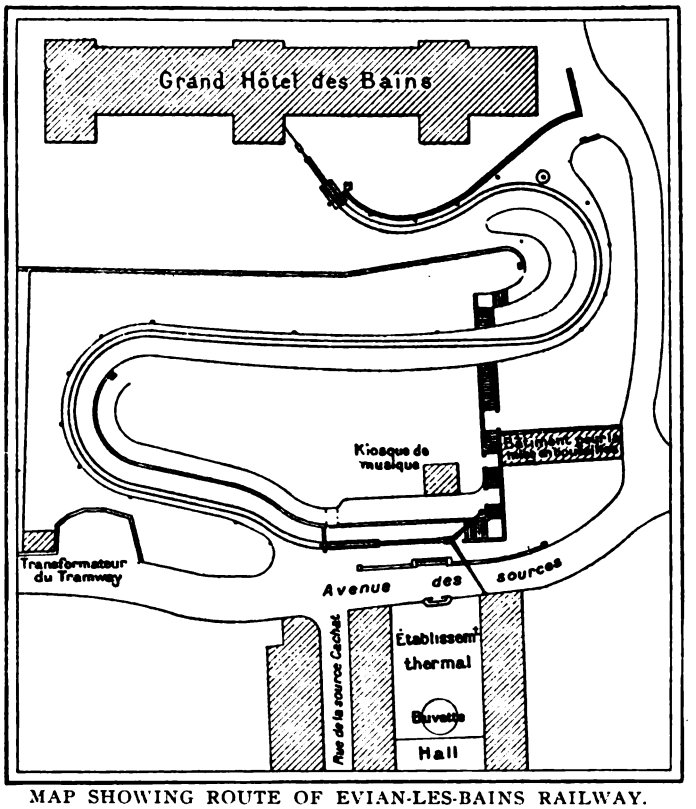
This line, constructed entirely on the grounds of the Evian Hotel Company, runs from the hot baths to the Grand Hotel des Bains, as shown on the map. The road starts from the refreshment room court, follows with numerous curves the large shaded alleys of the grounds of the hotel, emerging at the terrace of the Grand Hotel, where a magnificent view is presented to the eye. The beauty of the landscape, the comfort and elegance of the car, the interior decorations of which recall those of the Austro-Hungarian imperial train, make the passengers regret the shortness of the journey.

The trip takes two minutes, or, more exactly, it requires one minute and forty-five seconds to go the distance of 987 feet, between the hotel and the hot bath establishment, which corresponds to a speed of six and a quarter miles per hour. This low speed was adopted on account of the contour of the road which presents numerous curves, 50 feet in radius, and grades attaining almost 10½ per cent. on curves of 108 feet. On the line at Lugano, started two years ago, it may be recalled that the maxi-

Digitized by Google

mum grade did not exceed 6 per cent. Besides, the grades are continuous, except two levels of about sixteen feet at the termini. But the difficulties resulting from the undulating profile of the road are but secondary, when compared with those proceeding from the supply of current to the railway itself. This is accomplished by looping it directly on to the lighting system like an ordinary motor, so that the motors of the railway represent a rather large fraction of the power distributed to the village of Evian, and must be so controlled as not to produce any fluctuations in the lighting system. The necessary precautions involve difficulties due to handling with care the starting resistances, and maintaining the ærial line in good shape in order to avoid derailments, and insufficient contacts of the trolley wheels. The generating station situated about six and one-half miles distant, in the town of Chevenaz, on the banks of the Drause, delivers a three-phase current at 5,000 volts. The primary line is composed of four wires, of which one is neutral. This distributes the current to the entire city of Evian after its voltage has been reduced by transformers.

The lamps operate at a voltage of 120 and the railway at 200. The overhead line consisting of two bronze wires each .23 inch in diameter, is supported on handsome wrought iron brackets fastened to the poles. Around curves of 50 feet radius the poles



MAP SHOWING ROUTE OF EVIAN-LES-BAINS RAILWAY.

are placed 33 feet apart. The third conductor is the track itself, the joints of which are connected by strips of copper attached by means of double conical rivets. The rails are of the Vignol type of steel, weighing 16 to 24 pounds per yard.

The three conductors coming from the transformers are carried to the point of distribution at which place are located a three-pole interrupter, a three-phase meter, amperemeters and recording voltmeters, which record the pressure at each instant, so as to guard against fluctuations capable of affecting the lights.

The car is 16 feet long and weighs, empty, 7,700 pounds. It will seat eight persons, and the two platforms can hold four persons each, making a total capacity of sixteen persons, including the motorman and conductor. The body of the car is fastened to the axles by means of a double elastic suspension formed of wire springs. The motor receives its current from the overhead line by a double trolley. The arrangement of the Lugano trolley has been very much simplified. In the old system the two trolleys were placed one behind the other and were entirely independent of each other. In this installation the two trolleys have their poles mounted on the same base turning about a ball pivot and controlled by a steel spring in common.

The two poles are made of steel tubing sufficiently flexible to allow the trolleys to follow the overhead wire regardless of the variation of height of the latter. One of the two poles, insulated

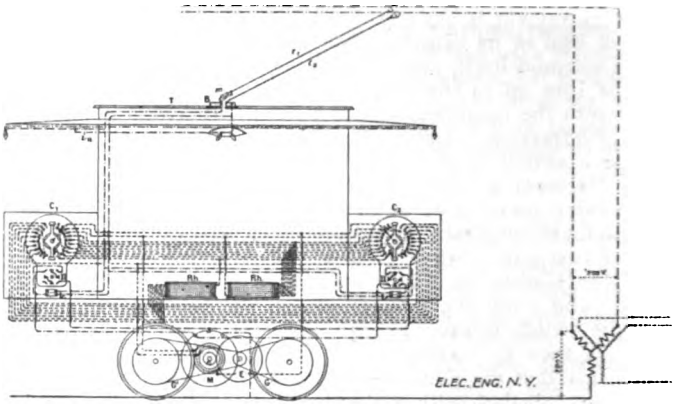
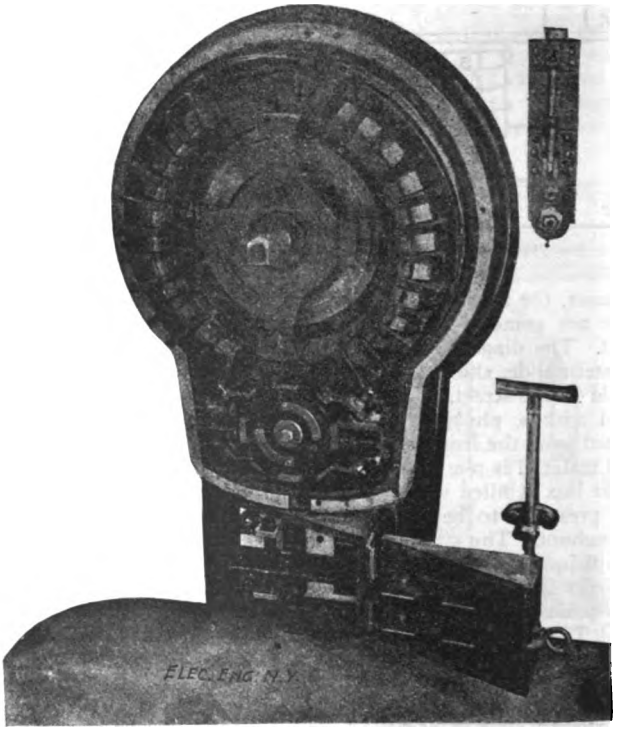


DIAGRAM OF WIRING OF CAR, EVIAN-LES-BAINS RAILWAY.

from the base by a bushing of ebonite, is connected to one of the ends of the inductor circuit of the motor by a ring placed around the axis of the pivot and carefully insulated from the roof of the car body. The base is connected to the second terminal of the motor, the third one being connected directly to the frame. The car has but one motor placed between the two axles. Its normal capacity of 15 h. p. ran up at the time it was tested to 28 h. p. for more than one hour. Its weight is 1,760 pounds. The inductor winding is three-phase and the induced circuit two-phase with the common wire at its three extremities connected to three rings, permitting the insertion of the regulating and starting resistances.

The motor, like that of the contiuous current type, is completely encased in a cast-iron box which protects it from dust and moisture.

In order to be able to inspect the condition of the motor and gain access to the rings and bearings, there is located in the front of the box an opening which can be tightly closed by a lid. The motor has eight poles, and with a current of 50



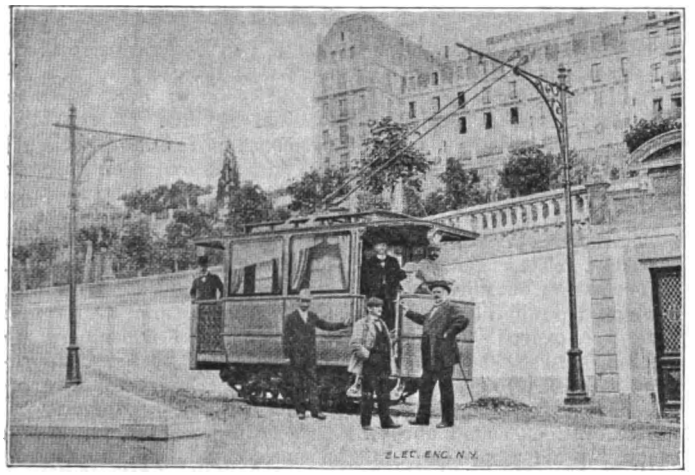
THREE-PHASE RAILWAY CONTROLLER, EVIAN-LES-BAINS ROAD.

periods it makes about 700 revolutions per minute with a variation of 6 to 7 per cent. It is connected to both axles by means of a double reduction gearing with a coefficient of one-quarter

Digitized by Google

and wheels with Galle chains having the ratio of ½ to 3. Each platform is provided with a controller, shown in the figure. To the right of the conductor is located the controller handle, in the middle the alarm bell and lastly the handle for operating the sand box. The controller is composed of two entirely distinct parts, but connected mechanically. At the lower end is an interrupter for reversing the inductor circuit. Below is the apparatus for throwing in and out the rheostat which consists of nine steps for the forward movement and two for the backward movement. The rheostat consists of a series of iron plates and is laminated with sheets of asbestos. The variation is produced without shock when the intensity is 15 to 20 amperes. It should be remarked that the speed is practically constant, whatever the grade and curves may be, the amperes alone varying from 30 to 70.

In the descent an electric brake is used, the principle of which is quite different from that used on continuous current railways. In these the electric brakage permits of a very small variation of speed, while with the three-phase system one cannot reduce it below the normal speed, the motor having to exceed the speed of synchronism before it can act as a brake. A certain danger is possible from derailment of the two trolleys, but in a well-equipped line this accident is not liable to happen, and in case one trolley should derail, the other is sufficient to transform the motor into a generator. Besides, the car is furnished with a shoe brake, which in case of accident can quickly bring the car to a standstill in the ordinary way. Aside from small inconveniences the electrical braking of three-phase motors presents certain advantages, more apparent in large installations. Besides its simplicity, for it does not need a supplementary controller, the plane of the forward movement and those of brakage are the same, and we can employ its regulating influence on the current generated at the central station. Less energy is wasted than by the continuous current motor, as the three-phase motor becoming a generator aids the current on the line and also adds its share to the production of current in the generating station.



VIEW OF CAR AND LINE CONSTRUCTION, EVIAN-LES-BAINS RAILWAY.

The adhesion on steep grades, as well as the brakage on the descents, is assisted by the employment of an entirely new sand box. Under the front platform of the car can be seen an iron cylinder within which are two chutes which deposit the sand in front of the wheels. Within this fixed cylinder is a movable cylinder filled with sand, and which has two orifices. A pinion and a toothed wheel operated from the platform by a lever, permit a half turn of the cylinder making the two upper orifices in the movable cylinder to correspond with the two lower orifices in the fixed cylinder. At each movement of the sand box all the sand is violently shaken and can be sifted out with great facility.

The firm Lombard-Gerin & Co., in spite of the very short time given them for the study and execution of this railway, did not hesitate to propose the three-phase solution of the problem, which, in this particular case, proves itself simple and practical.

The excellent results achieved on this road permit one to conclude that electric traction using the three-phase current from now on may be considered a practical solution of various traction problems.

We are indebted to "La Revue Technique" for the above details and to that journal and "L'Industrie Electrique" for the illustrations.

ALTERNATING CURRENT WIRING AND DISTRIBUTION. By William Le Roy Emmet. New York, 1898. The Electrical Engineer. Second Edition, revised and extended; 4½ x 7 in.; 98 pages; cloth. Price, $1.

Mr. Emmet's work is so well known and appreciated that it seems hardly necessary to revert to it again were it not for the fact that a second edition has now made its appearance. In this edition the author, while retaining all his useful explanations and methods for determining the proper methods of distribution, has added a large amount of useful information and hints bearing directly upon the question of proper wiring where an alternating motor load is included in the system. It is to be noted that most central station managers have in the past, as it were, "reckoned without their host," and hence the hints and other useful information on motor load given in the new edition of Mr. Emmet's work will prove of special value. In fact, there is no case in alternating current distribution whether for local or for long distance work that Mr. Emmet does not treat of specifically, and one might say, work out by example; so that the book is adapted, as above stated, to all classes of alternating current distribution work. An appendix on General Wiring Formulæ with a very valuable table of wiring for 30, 65 and 125 cycles, and for single-phase, two-phase and three-phase work is added. We may safely say that no station manager can afford to be without this handy volume on his working desk.

THE STORAGE BATTERY, A Practical Treatise on the Construction, Theory and Use of Secondary Batteries, by Augustus Treadwell, Jr., E. E. Cloth, 257 pages, 117 illustrations; price, $1.75. Macmillan.

This work is of special value to scientists, especially those interested in electricity as applied to storage batteries, and contains a description in detail of the latest inventions and most economical plans relating to storage development. Chapter I is devoted to the classification of batteries, Reynier's classification, as modified by the author, being employed. Chapters II., III. and IV. are devoted to the lead-sulphuric acid group. This class includes all those cells belonging to the Planté and Faure groups, thus including the great majority of batteries in use to-day, about 114 cells being described. Chapter V. is devoted to those batteries in which one or both electrodes are of some other metal than lead; this includes the lead-copper, lead-zinc and alkaline-zincate genera and miscellaneous types, 26 cells being described under these four heads.

Chapter VI. is devoted to the theory of the storage battery. This chapter was submitted to and approved by a prominent chemist, and will be found to give the latest views of the most prominent investigators. Two chapters are devoted to storage battery applications, first as applied to lighting and power plants and telegraphic work, and second as applied to traction purposes. In Chapter VII. the most prominent lighting and telegraph plants are described and illustrated. In Chapter VIII. many prominent storage battery roads are described, both as to equipment and running cost and the growing subject of automobiles carefully considered. Chapter IX., on the management of storage batteries, will be found to be complete in every detail and to give the latest and best practice concerning the manufacture and use of storage batteries. In the Appendix will be found rules for the measurement of the e. m. f. and internal resistance of batteries and data for the calculation of the theoretical and practical calculation of storage battery elements.

Unique features of the book are the table giving data for all storage batteries on the market to-day, and a great number of charge and discharge curves for the more prominent types. In the table will be found such data as will enable batteries to be easily compared, together with the names of the investigators who conducted the tests.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 2, 1888.*]

Vol. XXVI. NEW YORK, OCTOBER 20, 1898. No. 546

Manchester Standard Wiring Rules and Regulations.

THE question of standardization of materials, methods, terms and symbols is one to which periodic reference is made in these columns, this being quite in accordance with the manner in which the subject is taken up by numerous municipalities and scientific bodies. Again and again attempts are made to find a satisfactory solution for the various problems which present themselves, but so many obstacles are continually met with, so much "red tape" has to be overcome, and the state of the art is undergoing so many changes that it may well be asked whether standardization will ever be realized. Each attempt, however, designed to approach a solution, is received with satisfaction and deserves encouragement. In our own country we have fortunately recognized the necessity of a national settlement of all questions of this character affecting more than one set of workers and the adoption of rules applicable in all parts of the Union. This fact is evidenced by the set of wiring rules formulated two years ago by the joint committee appointed by several national bodies of engineers, underwriters and others interested in the matter. The rules thus adopted by these bodies have, on account of their national indorsement, become standard and applicable throughout the United States. Another step in the right direction, and one which has a bearing on this subject was the preliminary report of the Committee on Standardization of the A. I. E. E. submitted at their recent meeting at Omaha, which defined electrical terms and apparatus most ably and suggested standard methods of testing. That committee was composed of men representing every branch of the industry, and its work will for that reason undoubtedly receive favorable recognition. In this connection we might also mention the standard diagrams proposed by the Chicago Electrical Association. At variance, however, with this desideratum of united action is the practice of our English cousins, who, for unaccountable reasons, are adopting rules and regulations to cover the practice of each large municipality. These rules differ largely from, and often flatly contradict each other, the ill effect of which must be apparent. Thus, for instance, in Manchester it is ordered that the frames of all motors be connected to the ground and in Oldham they are to be efficiently insulated therefrom. Again, in Chelsea tin wire is to be used for fuses, in Islington tinned copper wire, and in St. Pancras tin strip stamped with the number of amperes of the normal maximum current it is to carry. Numerous examples of even more distracting discrepancy could be cited.

The most recent English production of this kind, and one which in itself does great credit to its Chief Engineer, Mr. C. H. Wordingham, is a pamphlet issued by the electricity department of the Manchester Corporation. It contains "Regulations as to the Supply of Electric Energy to be Observed by Consumers and Electrical Contractors." The rules as a whole appear to have been carefully framed, but some of them seem unnecessarily severe and exacting. It might, of course, be questioned whether the laying down of such regulations comes within the province of central station management, but if backed by an act of Parliament or a city ordinance, such a step may be productive of good. Among the chief points of novelty in the pamphlet is noticed a chapter dealing with the examination and registration of various designs of fittings. In future only those fittings will be allowed to be used which have passed certain definite tests, which are set forth in the regulations and a certificate to that effect is issued by the Corporation. Such fittings will be known as "Approved Fittings," and contractors will be entitled to use them without individual samples being tested during the period the certificate is in force, which is one year. It may be renewed from year to year at the discretion of the City Electrical Engineer without further tests of the article. This is certainly a step in the right direction, but it appears as if the same thing could be accomplished by prescribing certain conditions, mainly those of insulation, which would have to be complied with by the contractors.

There is a most interesting and in some places unique chapter on "Radiators," which term includes electric stoves, ovens, hot plates and cooking apparatus generally. The voltages at which continuous current will be supplied are 100, 200, 300, or 400, and not 110, 220 and 440, as is common in this country. The balancing of circuits is accomplished in a manner foreign to our practice, where no difficulty is experienced with the well developed three-wire system of distribution. In the words of the pamphlet: "For all purposes except motors, a demand up to 2½ k. w. will be supplied from one pair of terminals; above 2½ k. w. the consuming devices must be divided into two approximately equal circuits. If above 5 k. w. they must be divided into four approximately equal circuits. Current will be supplied at 200 volts for motors absorbing not more than 2½ k. w., i. e., 3½ elec. h. p.; above 2½ k. w. at 400 volts. Motors taking not more than ¾ k. w., or 1 elec. h. p. will be supplied at 100 volts, if desired."

Another requirement, the necessity for which does not seem apparent, relates to exterior wiring, namely, that all conductors, however they may be insulated or protected, must be laid in a wooden trough filled with Trinidad bitumen, and the trough must be covered with a board. Besides, the consumers are strongly advised to have such conductors laid by the Corporation, at cost price; and after they are once laid the entire responsibility for their maintenance rests with the consumer.

However, as stated above, Mr. Wordingham deserves great credit for his admirable compilation of regulations which, we understand, are well suited for English practice. But why these rules or similar ones are not approved by a representative committee and made standard throughout the country is still a mystery.

The Success of the Conduit Trolley.

THE New York papers have been busy the past week awarding contracts on behalf of the Third Avenue Railroad to various concerns—Westinghouse Co., Johnson Co., National Conduit Co. and others—for various parts of the equipment necessary for the adoption of the conduit trolley. These contracts, noted in detail elsewhere, run into millions, and we can only hope that they are all to be carried out forthwith, as it will put a lot of money in useful circulation. We note, however, that from different parts of the country come suggestions that other lines must also follow suit, because the franchises in numerous cities require the taking down of the overhead trolley lines just as soon as the success of some other electrical system dispensing with them has been duly established. Well, the conduit trolley seems to be a fair success in New York, but it does not yet follow that the system is everywhere advantageous. Even some of the lines where it might pay, have a heavy investment in their overhead lines, and are hardly in a position to raise new capital. As the "Engineering News" remarks, in touching on this point: "To bankrupt a city's railway companies will in the long run injure the city, and the patrons of its railways, as well as those who own the railways," and it adds that "the deadly overhead wire has an astonishingly small record of accidents against it."

Digitized by Google

Besides, as our contemporary points out shrewdly, there are other things worth bargaining for, which would become impossible with increased burdens of investment before the old plant has paid for itself and worn itself out. "Concessions in the form of reduced fares, especially to children and workmen; extensions to outlying suburbs in need of better communication; or even increased cash payments to the city as rental for the use of the streets, would in most cases, be of much more real value to the citizens than the removal of the poles and overhead wires." In other words, it becomes a matter of practical politics and economics rather than of technical accomplishments in regard to which little doubt now remains. We think that the overhead trolley companies thus concerned might, however, well ask for a surcease pending the development not merely of an open, slot conduit, but of a closed, surface contact method; and back of that, pending also the ultimate triumph of storage battery traction. They may well argue that perhaps the trolley-in-the-slot is only a partial, temporary solution of the matter, and does not affect their franchise pledges.

Submarine Cables in International Politics.

AN interesting article appeared recently in the "Revue des Deux Mondes," from the pen of M. Lazare Weiller, on the "Annihilation of Distance," and devoted to a historical discussion of the work done in telegraphy during the past one hundred years and in telephony during the past twenty. As might be expected, M. Weiller deals very instructively with the question of line material and the construction and laying of submarine cables.

It is with regard to the enormous development of submarine cable work in English hands that M. Weiller's remarks are of the most general interest, for if his views and wishes were carried out, there would certainly begin another great era of cable laying. After summarizing the cables laid by different nations, he cries: "What are these, however, alongside the endless English lines, which are ubiquitous, enclosing the entire world in a veritable spider's web?" He closes his article by pointing out what has recently been done by France in the North Atlantic, and says: "This is only a modest beginning, but it may serve at least, in the course of a year, to release our colonies in America from the telegraphic control of our neighbors across the channel."

Such a comment brings up many inquiries. M. Weiller assumes that cables exist for two purposes. One is political, the other is financial. Now, it is possible that the French colonies on this side of the globe are worth politically a special cable, but we doubt it seriously. On the other hand, the French cable regarded as a commercial enterprise is like any other, to be judged by its permanence and by the dividends it pays. M. Weiller associates the two aspects of the case in a striking manner when he surveys the situation elsewhere, and it is his programme of development that makes us call attention to "the way it strikes a Frenchman," to use his own language. We are often treated to alarmist articles on what would happen to England if she could get no grain, but there is another side to the story in considering what might happen to France, for example, if she could get no cable messages and send none. Looking at the strategic cables and cable landing points eastward from Gibraltar to Singapore, M. Weiller remarks that in case of a war: "While our governmental dispatches are destroyed or delayed, the English Admiralty remains free to issue all the needful instructions to move its fleets. Here surely is a serious peril, and one which would render the changes of a conflict singularly unequal." He further suggests the "well remembered cases of Morocco and Siam," when by the opportune breaking or blocking of the cable, "the English diplomatists were the first if not indeed the only persons to be informed of acts which equally concern other countries."

If we follow M. Weiller aright in what he is aiming at, though it may not be baldly expressed in his article, he would suggest an entire duplication on French account of the present English submarine cable system, representing not less than $150,000,000. Then France would be in touch with all her colonies quite independent of any other service, and able to reach her fleets and armies without interruption. Perhaps. First of all, points for landing these cables on French territory would have to be found, and that seems impossible, unless France proposes to obtain concessions or seize new territory for the purpose. Even should she be able to reach her fleets, the necessity of coaling stations, not less than cable stations, might make itself felt very disagreeably. It is with her as it is with us in our new foreign relations. Our colonies and possessions are not going to be safely American unless we can reach them and protect them by cables and coaling stations; but on financial grounds there does not appear to be much warrant for duplicating lines that English companies have already laid and which are adequate to the traffic.

It is an extraordinary fact that while the English cable lines do serve a strategic purpose, they earn a handsome income for the stockholders, and probably there would not be a mile less if all "imperial" considerations were dropped out of the reckoning. There may be some English cables existing and operating only because of their political value, but a close study of the map does not reveal them. If England encouraged cables for political reasons alone, she would certainly have had one from the Canadian Pacific shore to a Far East point long ago. But her diplomatists and capitalists have been waiting until it would pay commercially; and it is not built yet. For France to build where England, with enormous interests, has neglected to do so would, however, on any score, look like a reckless exposure of capital and property under very untoward risks and hazards; yet if Mr. Weiller wants a chance for new cable work for his country, there it lies rather than in some territory where the cables are already six and ten deep.

An Elevated Example from Chicago.

THE managers of the Manhattan Elevated system in New York talk as though they had the problem of the ages on their hands when invited to make a change from steam to electricity. Yet, as a matter of fact, there are many trolley roads in the country that have to deal with about as heavy a traffic as theirs, under far more difficult conditions, and there are elevated roads that have tried electricity with the results that might have been expected from the change. The South Side Elevated in Chicago was in pretty bad shape. It adopted the Sprague "multiple unit" system, and the data of some four or five months of trial points only in one direction. Up to the time of resorting to electricity, the operating expenses of the system had been 80 per cent. of the total gross income. Now, according to figures which we find in the Chicago "Record," there has been since the adoption of the "multiple unit" system, a reduction of 25 per cent. in operating and a gain of 50 per cent. in traffic. This means a new value for the stock, and quotations show that the significance of the situation is not overlooked, for the stock has been scoring high-water prices. The New York Manhattan with a saving of 25 per cent. in operating expenses and a gain of 50 per cent. in traffic would not long present the sickly front it now does.

As we go to press, it is again rumored that a contract for the equipment has been given out to the Westinghouse Company. The news is too good to be true. To borrow a phrase current in other matters, "there are several lives between" the benefit thus to be conferred and the New York public. If the change comes, we shall believe it, but it would be easier to believe if control of the road had passed into new hands.

Electricity on Brooklyn "L" Road.

Mr. John Lundie, of Chicago, has been appointed special engineering expert of the Brooklyn Elevated Railroad Company. He is at present associated with the Illinois Central Railroad Company in a position similar to his new one. It will be his duty to inspect the road and prepare plans, specifications and estimates for equipping the Lexington Avenue and the Fifth Avenue lines with electric motive power. It was said at the office of the company last week that the work of equipping the road would be begun about the middle of next month, and that before the work is completed the company will be out of the hands of a receiver.

Lighting in Turkey.

Concessions for electrical lighting and traction in Smyrna and Salonica have been granted by the Porte to Sir Ellis Ashmead Bartlett, M. P., who stood out for Turkey in England at the time of the Armenian massacres. Priority of right is promised him also in Constantinople whenever the Sultan makes up his mind to allow electricity in his capital.

Digitized by Google

ELECTRIC LIGHTING.

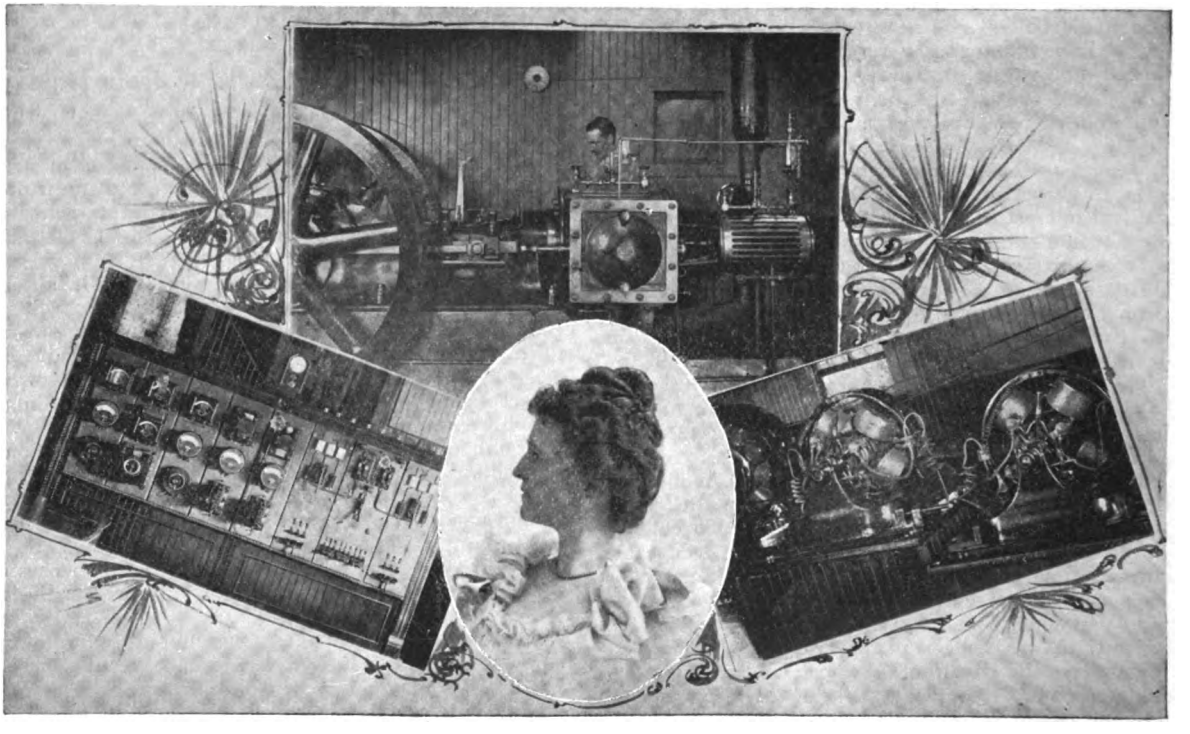
The Plant of the Long Beach & San Pedro Electric Co.

THERE are many charming resorts and prosperous cities growing up on the coast of Southern California, and none of them have brighter prospects than Long Beach, near San Pedro, and practically constituting a part of what may be called Greater Los Angeles. The feature from which the town derives its name is a great attraction, and in all the elements that go to make a modern city agreeable to live in all the year round Long Beach is also well to the front. One of the most interesting points in its development has been the part played in its electrical affairs by a woman.

The story is one of unusual interest and worth the telling. In the spring of 1895 Mrs. Iva E. Tutt applied for and obtained a franchise granting her the right to erect, operate and maintain an electric plant to supply light, heat and power in Long Beach, and she immediately began negotiations for the purchase of property and the necessary machinery and electrical equipment. On July 25, 1895, the plant was in successful operation, and the service has been continuous and growing to the present time. In the fall of the same year she applied for and obtained a similar franchise in San Pedro, and on April 7, 1896, the transmission line connecting the two cities by way of Terminal Island and by a submarine cable under the inner harbor at San Pedro, being completed, the two cities were connected, and were successfully lighted from the same central station. Terminal Island has since been added, and makes a brilliant showing at night, with the long rows of wharf and sidewalk lights and the brilliantly illuminated club house and cottages.

The company was incorporated in 1896, and has been under the personal management of Mrs. Tutt, who is equally at home in the management of its business affairs and in the operation of the station apparatus. With regard to the plant and its operation, Mrs. Tutt writes us as follows:

"Our plant is a small one, but is a model one as well, as we have been careful to always install only the most efficient apparatus and to arrange the station with a view to enlarging without at any time affecting the general plan of the whole. We use Sterling water tube boilers, with a steam pressure of 180 pounds; Ball tandem compound engine, 320 revolutions per minute, General Electric compound wound generator, 1,500 revolutions per minute, Fuller duplex water pump and rotary oil pump. The question of fuel is, or has been until the past few years, the one serious problem in the development of power in Southern California. It has been solved by the use of crude oil, which is a natural product of this section and is rated on the basis of coal at $3 per ton. Our fuel is pumped into an 8-inch stand pipe, with an overflow pipe which maintains an even pressure of 13 pounds on the gauge and feeds to a Wilgers burner by gravity. This burner is the invention of a Los Angeles man and is the best on the market for this grade of oil. It consists of a simple but effective device by which the oil is sprayed in fan shape onto a jet of live steam. In our case the steam is superheated by passing the steam pipe through the furnace and a perfect combustion is the result, assisted no doubt by a mechanical draft, which is produced by an electrically driven fan, the motor and fan being placed in the ash pit door. The oil is piped directly into our tanks from the tracks of the Los Angeles Terminal Railway and feeds by gravity. Our floors are cement throughout; the switchboard is slate. The main line, carrying 2,000 volts, connecting the city of San Pedro with the power house, runs under the inner harbor at the narrowest point, the cables being about 10,000 feet long. We have never had any trouble from leakage or with the fuse boxes at the junction of the cable and main lines. Never, did I say? I mean only once, when some individual whose curiosity got the best of him, cut through the lead armor and through the rubber insulation under the pier where the cable lands, at low tide, and when the tide came in naturally the lights went out, likewise one large transformer which went up in noise and smoke. However, we have been very fortunate so far, and hope to continue to be, but it means constant care, in this as in all business affairs, if one expects to succeed. We have twenty-seven miles of main lines and three large transformers, with three-wire secondary distributions from each. On our street circuits we use 220 volts, two lamps in series on each standard. To allow for line losses we use 110 volt lamps at Long Beach nearest the station, 104 volts at Terminal Island, the next on the line, and 100 volts at San Pedro, five miles away, the



Switchboard. LONG BEACH AND SAN PEDRO ELECTRIC COMPANY. Mrs. Iva E. Tutt, Manager. Engine Room. The Dynamos.

Digitized by Google

pressure being maintained at all points equally. Our service has also been only interrupted once in the past seven months, and that for fifteen minutes at 11 o'clock one night, when a nut worked loose on the piston rod. Of course, fuses blow sometimes and lamps burn out, but the station work is uninterrupted."

It may be added that the officers of the company are E. S. Tutt, president; C. C. Glass, vice-president and electrician; Iva E. Tutt, secretary, treasurer and general manager, who are directors with F. J. Thomas and W. M. Glass. The capital stock is $50,000. The plant, which we illustrate herewith, is kept in very neat and efficient condition. We are glad to accompany the views of it with a portrait of Mrs. Tutt, the general manager, whose intelligent grasp of her work is well indicated by the remarks from her letter, quoted above.

The Use of Electric Balloon Signalling in Arctic and Antarctic Expeditions.[1]

BY ERIC BRUCE.

THE author said the absence of means of intercommunication was one of the most distressing deprivations which befel the Arctic and Antarctic explorer. In Dr. Nansen's recent expedition, the want of some bond of communication between the drifting ship and a party leaving the vessel for only short excursions was severely felt, and greatly restricted the researches of the expedition. A means of communication could be afforded by the system of electric balloon signalling invented by the author, adopted for war signalling purposes by the British, Belgian, and Italian Governments, and lately adapted to the wants of Arctic and Antarctic exploration. Signalling with flag or lantern from the car of an ordinary captive balloon, worked from the deck of a ship, was possible, but such a method necessitated a large balloon, with its cumbersome accessories, and was therefore impracticable in Arctic expeditions. In electric balloon signalling, the signaller and most of the apparatus remained on the ground or deck of the ship. Since the weight of the car, signaller, and apparatus was abolished, the balloon could be of such a moderate size as to be practical. The apparatus consisted of a balloon made of a translucent material and filled with hydrogen or coal gas. In the balloon were placed several incandescent electric lamps in metallic circuit with a source of electricity on the ground or deck of the ship. In the circuit on the deck was an apparatus for making and breaking contact rapidly. By varying the duration of the flashes of light in the balloon, it was possible to signal according to the Morse code. In the signalling key there were carbon contacts, renewable when worn away by sparking. The key was placed on a switchboard, which was provided with a means of turning the current on to the lamps in the balloon, either through the key or directly for continuous illumination. The speed of signalling depended entirely upon the thickness of the carbon filaments in the lamps. The material selected for making electric balloons that were designed for Arctic work was goldbeaters' skin, which was light, strong, and retentive of hydrogen. The smallest size goldbeaters' skin balloon that would lift the lamps and a sufficient quantity of cable to be useful was 7 feet in diameter, having a capacity of 150 cubic feet. It took little over one tube to fill it. The electric incandescent lamps inside the balloon were supported one above the other on a holder made like a ladder. That form of ladder was convenient for admission into the narrow neck of the balloon. The electric cable combined lightness, flexibility, and current capacity, being made of strands of copper, both leads being enclosed in one waterproofed outer insulation. The source of electric power for lighting the lamps in the balloon would probably be the dynamo, with which every future exploring vessel would probably be provided, and which could be efficiently worked with wind or hand-power. If a balloon and accessories were taken from the ship by an excursion party, light and portable storage cells could be used. The gas for filling the balloons could be compressed in steel cylinders, or a portable apparatus could be used for making the hydrogen on the spot. This system of signalling made the signallers fairly independent of the configuration of the country. An electric balloon ascending from the deck of the exploring vessel would not only act as a beacon guide to exploring parties, but would flash signals relating to the drift of the ship or any other desirable communication. If an exploring party could take another balloon with them, complete intercourse could be established. If the Fram had had an electric balloon afloat, it would have been probably seen by Dr. Nansen when he was returning from his journey North, and possibly a long and perilous march might have been avoided. An electric balloon would have been an important addition to an Arctic station such as Elmwood. The electric balloon had been successfully manipulated, not only in calm and fair weather, but in half a gale, a snowstorm and mist; signals had been read and answered in spite of these adverse atmospherical conditions. Arctic records, however, included a large proportion of still and clear weather. Continuously illuminated, and sent up a short distance from the ship, the balloon would also be serviceable as a light for working parties, because of the diffusion of light from the large surface. Regarding the distance to which signals might be transmitted, it was reasonable to expect that, given a sufficient altitude, a high candle-power, and a clear atmosphere, through a telescope the flashes would be visible some 80 or even 100 miles.

Mr. Douglas Archibald, who had used kites for meteorological observations since 1884, said there were grounds for believing that kites would support a considerable weight, and transfer it from one place to another, gliding down gradually. But he thought the kite in conjunction with the captive balloon the better idea. Kites could be used for taking photographs of a country, and he believed they were destined to be used very much in future wars.

[1]Paper read before the Brit. Asso.

Some Views and Data On Municipal Ownership.—II.

BY HENRY HOPKINS,
Supt. Street Lighting, New Haven, Conn.

I HAVE in the previous article shown that the usual life of municipal servants is short owing to change of political sentiment and power, and that such servants are liable to be tied with more or less red tape. It also makes a great deal of difference to the officers and men if the general commanding them has full power to act, and to conduct an aggressive warfare, or whether he must wait for orders from headquarters to move on the enemy. Our late war has shown that.

We will now consider one of the causes that lead to municipal agitation. Certain papers print statements in relation to cost, very seldom giving anything but the price or contract rate. Well, we will treat on that question, and as I am more familiar with street lights than railways or water works, I will quote statistics of the former. Does not the number of lamps used, the candle power of gas, the size of the burner whether it burns 3, 4, 5 or 6 feet of gas per hour, whether the lamps burn 1,080 or 4,000 hours per annum make some difference? To my knowledge, there are over fifty different schedules of hours burnt, whether the city or contractor furnishes any or all of the fixtures, or a whole or part of the labor, and who does the repairs and reglazing, etc. Nearly all the above points will apply to naphtha lamps. In the case of arc lights, the candle power; who owns the fixtures, pole lines, etc., whether steam or water power is used are all points of importance. And governing the gas and arc systems are the market price for labor, cost of coal, and freight. These are local conditions and must be carefully adjusted to make a correct and intelligent comparison. It is to be regretted that reliable statistics so valuable are not more easily obtained.

Again, every city department has a different mode of bookkeeping, not an intentionally dishonest method, but often one calculated to make a good showing. This fact occurs over and over again in municipal ownership. The annual report shows a certain cost. A letter to the city clerk elicits another figure. Members of the court of council claim another. An expert is called in, and after a long and laborious task (which should not be so) yet another cost is obtained and a greater one, too.

Does this not show that experienced men to run complicated and scientific plants are needed?

Digitized by Google

LOSSES.—Losses by waste, if allowed to continue, will take the cost above contract price in every case. Are we as apt to be as careful of what does not belong to us, as with what is our own? We should be, of course, but are any of us?

Now we come to the more serious points—the finances—for example, the taxes the city would lose if the corporation or private company was driven out of the field. Moreover, what successful business these days that is governed by continual improvements in methods and machinery, can continue in competition without considering the question of depreciation caused by new inventions, as well as the inevitable wear and tear of operating apparatus. Three per cent. is too low, 5 per cent. questionable, 7 per cent. more safe. Insurance on the plant; a certain per cent. of the repairs; amount paid for water used, as well as interest on the investments, and bonds, should be added to the cost of the lights to get an accurate and fair cost; then add cost of labor and other running expenses, and we will find that there are not millions in it. Commercial lighting is spoken of to help cut down the expenses. If this is to be done, why not run the bakeries, the stores and all the rest of the shops, and let everybody get all they want at "actual cost." What a curious place this would be to live in, with no business run for a profit, and, therefore, no increase in the public wealth!

TELEPHONY AND TELEGRAPHY

The Boston Exchange District of the N. E. Tel. and Tel. Co.

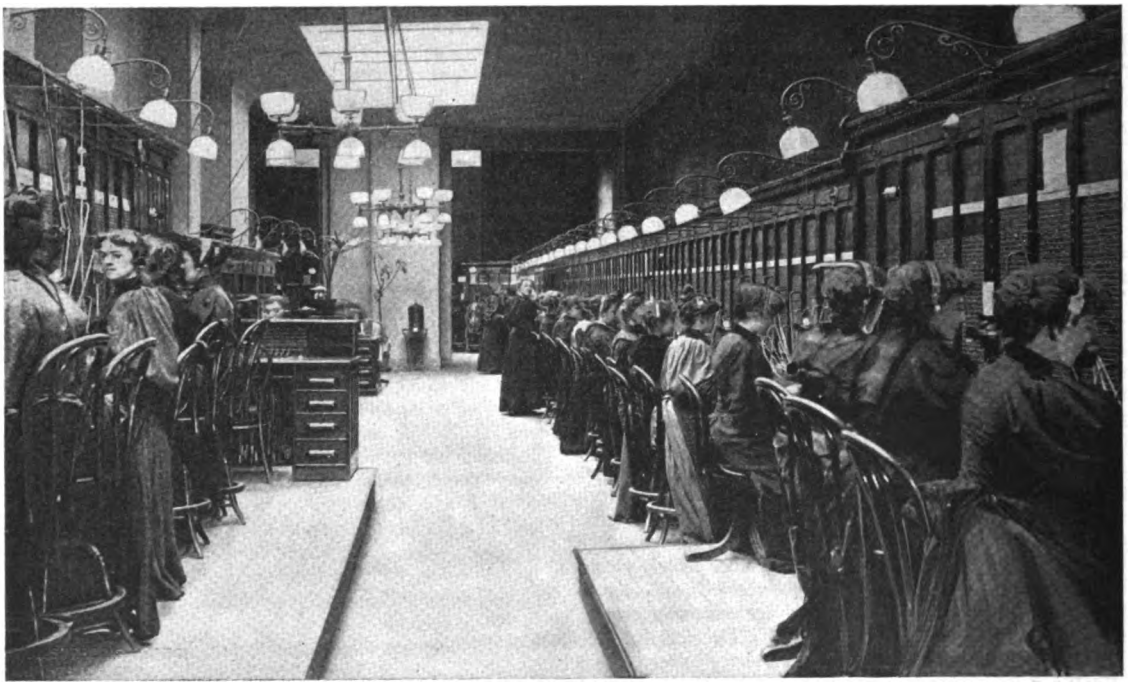
ONE of the largest and most important telephone exchanges in the country is that of the New England Telephone and Telegraph Co., in Boston, where the parent American Bell Telephone Co. is also seated. Not only is the central exchange a very busy one, but owing to the great development of the residential suburbs of Boston, the sub-exchange system is most complete in the provision made for that special class of business.

The Boston Exchange district includes five exchanges located in Boston proper, as follows: Main office, 125 Milk street; Haymarket office, at 7 Chardon street; Oxford office, on Oxford street; Tremont office, on Albion street; Back Bay office, at 208 Newbury street, and 34 Suburban exchanges, as follows: Brighton, Charlestown, Dorchester, East Boston, Jamaica Plain, Milton, Roxbury and South Boston, all within the Boston city limits; and Arlington, Brookline, Cambridge, Canton, Chelsea, Dedham, Everett, Hingham, Hyde Park, Lexington, Malden, Medford, Melrose, Newton, Newton Highlands, Norwood, Quincy, Revere, Somerville, Wakefield, Waltham, Wellesley, West Newton, Winchester, Winthrop and Woburn.

The five exchanges located in the heart of the city have direct communication each with the other by a system of local trunks equipped with automatic visual signalling devices that make it possible to transfer calls between them with very great promptness. The Boston main office is made the relaying point for calls between the five principal offices and the suburban exchanges, all trunks to and from suburban exchanges centering in the main office and being there handled under a system that permits extremely rapid transfer of calls to and from suburban exchanges with a minimum amount of labor.

There are connected with the principal exchanges in the heart of the city 7,717 subscribers, as follows: Main office, 3,455; Haymarket, 2,003; Oxford, 910; Tremont, 567; Back Bay, 782, and the suburban exchanges, 8,836 subscribers.

The toll line operating department is located in the operating room of the main exchange, the work of which may be divided into three principal divisions, as follows: (A) Toll line operating; (B) Switching; (C) Subscribers operating positions. In the toll line department there are 35 operators, handling 100 toll lines and 102 public station lines; in the switching department there are 38 operators, handling an average of 1,600 calls per day each; in the subscribers operating department there are 53 operators, handling an average of 850 calls per day each. The total number of calls handled daily by the Boston main office is about 85,000.



OPERATING ROOM, MILK STREET EXCHANGE, BOSTON.

The People's Telephone Co.—Competition in Greater New York.

THE directors of the People's Telephone Corporation, a new company which was corporated in Albany last week with a capital stock of $5,000,000 for the purpose of establishing and operating a telephone system in the Greater New York territory, are unanimous in asserting that the company intends to fight the telephone trust and will under no consideration sell out its interests to the Bell Company. In fact, it is said on good authority that all the stockholders of the new company have signed an ironclad agreement to the effect that they will not dispose of

Digitized by Google

their stock to any one without the consent of the majority of the incorporators of the new concern. This arrangement, it is thought, is designed to prevent the Bell Company from securing control of the new company, no matter what inducements may be offered.

The directors are Silas B. Dutcher, J. E. Nichols, E. S. A. De Lima, Francis C. Travers, Frank Brainard, J. Fred Ackerman and Darwin R. James. The last named denies most emphatically that the new company has any relation whatever to the Board of Trade and Transportation beyond the mere fact that a number of men interested in the latter organization happen to be stockholders in the former concern. He admitted, however, that the Board of Trade and Transportation has for some time been fighting the telephone monopoly and that it would doubtless be pleased at the prospect of cheaper telephone rates for the people of Manhattan and Brooklyn. In addition to the directors the following are incorporators of the new company: Gen. E. A. McAlpin, of D. H. McAlpin & Co., tobacco manufacturers; Gen. E. L. Molineux, of F. W. Devoe & C. T. Raynolds Co., paint and color manufacturers; Martin Schrenkeisen, of Schrenkeisen Co., furniture manufacturers; Ludwig Nissen, jeweler, president, of the Manufacturers' Association of Kings and Queens Counties; Frederick Potter, trustee of the O. B. Potter Trust; E. A. Cruikshank, former president of Real Estate Exchange; B. Fisher, president of American Encaustic Tiling Co.; Lee Kohns, of L. Straus & Sons, china, etc.; William H. Wiley, fruit importer; Washington Winsor, president Mercantile Exchange; Jeremiah Pangburn, Jr., secretary of Coal Trade Protective Association; Milton Knapp, of Knapp & Mangam, grain; C. S. Mead, secretary New York Merchants' Association; James G. Johnson, of J. G. Johnson & Co., millinery goods; Eugene H. Conklin, of Mulford, Cary & Conklin, leather; C. J. Gillis, of Gillis & Geoghegan, steam heating apparatus; Adrian Paradis, retail druggist, president of Kings County Pharmaceutical Society, and George Thomson, president of New York Butchers' Calfskin Association.

Mr. Frank S. Gardner, the secretary of the New York Board of Trade and Transportation, says: "The People's Telephone Co. has all needed rights. In about a year it will compete actively with the former monopoly, and an immediate cut will be made in the unlimited service rate in Manhattan from $240, the present price, to $100, the new company's charge, which includes the right of free use of its public pay stations for 100 calls per annum per subscriber. The message service rates for business places will be cut from $90 for 600 messages to $40 for 400 messages. For larger numbers of messages on the message schedule, the rate goes as low as 4 cents per message. The residence message rate for service on private wires will be $30. To families living in apartment houses and flats an unlimited service, connecting with all the other subscribers of the company, will be given for $1 per month on group lines. The unlimited service for business places in Brooklyn will be cut to $75 per year, the old company's rate being now $150. The company will be able to give a subscriber connection in ten seconds from the time a signal is sent." The nature of the apparatus to be used is not yet disclosed. It is said to be new.

Illegality of Slot Telephones in Chicago.

A SPECIAL dispatch from Chicago of Oct. 10 says: In an opinion rendered to the judicatory committee of the city council to-day, Corporation Counsel Thornton holds that the slot machine telephone as used by the Chicago Telephone Company is illegal. Under an existing ordinance the telephone company is given permission to furnish telephone service to the public in accordance with a schedule filed with the city clerk. Counsel Thornton contends that the company has no right to charge any extra to an outsider for the use of the telephone when the company is already being paid by the party renting the telephone and leaves it to the option of the latter whether he shall make an extra charge or not.

The trouble originated in an attempt on the part of the renters of telephones to make the instruments a source of revenue instead of expense. This they did by paying the extra fee of $25, which the company charged when telephones hired by individual customers were placed at the service of the public, and then collecting a fee of 10 cents from every outside user. The company asserted that these fees should go, not to the person on whose premises the instrument was established, but to itself. The claim was based on a somewhat obscure clause in the company's contract with the city, whereby the company is required "to permit the use to the general public, and charge therefor 10 cents for a local connection, and $25 increase upon the price to be charged for a private telephone." The renters, on the other hand, saw in these words merely a prohibition against their fixing a rate higher than 10 cents for transient service. Ignoring this interpretation, the company proceeded to substitute "dime-in-the-slot" telephones for the ordinary ones in all cases where the patronage of outsiders was invited. Strenuous opposition was made to this change, but the company enforced its contention by refusing to make public any except the new machines. Then the city council took the matter up, and now the Corporation Counsel has rendered the formal opinion in favor of the company's rebellious customers. "The income from a public telephone," he says, after quoting the clause given above, "plainly belongs to the lessee of the telephone instrument where it is open to the use of the general public. It is plainly optional with such lessee whether he will make the charge or not, and the limit of the income to the company from the public use of that telephone is plainly $25, in addition to the price charged for the business use of the lessee and his employees alone." This view, if sustained by the courts, will abolish slot machine telephones in Chicago.

Independent Telephony in Cleveland.

The Lorain, Ohio, "Daily Times," says: J. B. Hoge has just decided to take the management of the Union Suburban Telegraph & Telephone Co., of Cleveland. The company has a capital stock of $1,000,000 and proposes to establish a system of suburban telephone lines over the State of Ohio. Mr. Hoge is the secretary of the company. He has taken offices at 716 Garfield Building, Cleveland, which will be his headquarters hereafter. Mr. Hoge will retain his official position with the local bank and will be at the bank every Saturday. He will, also, continue to reside here. Promotion has come to him as the result of hard work and excellent business ability. He commenced at the lower rounds of the ladder and is rapidly reaching the top. The confidence being reposed in him by Cleveland capitalists is the highest tribute that could be paid to his business capability. The people of Lorain wish him well and they are doubly gratified that his step into a larger business field will not cause him and Mrs. Hoge to lose their residence in Lorain. Harry Critchfield, who was a candidate for nomination to Congress by the Wellington convention, will be the general attorney of the company.

$3,000,000 for the N. Y. & N. J. Telephone Co.

Announcement is made that the New York and New Jersey Telephone Company proposes to increase its stock from $5,000,000 to $8,000,000. At a meeting of the directors held about two weeks ago the increase was decided upon, and a circular was issued to the stockholders, calling for a meeting on the 27th of this month, and explaining the necessity for the action. The increase is to be used in making extensions and improvements to the system, but it is not probable that all the three millions will be put out at once. Rather it will be put out as has been the custom of the company on similar occasions in the past, in small amounts as the occasion demands. The new stock will be issued to the stockholders at par.

Telegraphy in the Klondike.

The Hon. John Roche, a member of the British Parliament, who is at present in Ottawa, expresses the opinion that by Jan. 1 next a land telegraph line will be built between Dawson City and Skaguay, and as soon as possible afterwards the latter place will be connected by cable with Vancouver. Mr. Roche represents a number of English capitalists who have acquired the charter granted by the Dominion Parliament last session to a company to build this line from the coast to Dawson by way of the Yukon and its affluents. The plan is to construct a double land line from Skaguay to Lake Tagish and Fort Selkirk to the Klondike, following the present mounted-police route, so that the police posts may be used as telegraph stations. Work is to begin immediately.

ATLANTA, GA., has voted in favor of a municipal electric light plant.

Digitized by Google

NEWS & NOTES

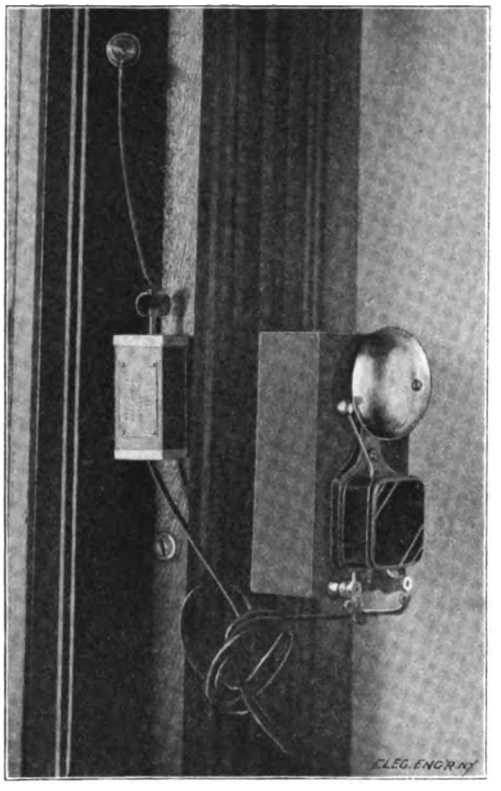
The St. James Portable Electric Burglar Alarm.

THERE has been considerable demand for a burglar alarm which could be readily connected or disconnected, and carried in a grip or trunk. To meet this demand the apparatus shown below has been put on the market by the St. James Electric Co., of which Mr. Charles L. Eidlitz, the well known electrical contractor, 1133 Broadway, is the president.

The instrument consists of a small wooden box or case about 5½ inches in height and 1½ inches in depth, containing two small dry cells which are connected in such a manner that the binding posts on the bell form the two connecting points; a small wooden cylinder with a plunger which is insulated on one end keeps two springs apart when inserted to a given distance and when either withdrawn entirely or partly inserted makes a contact, causing the bell to ring.

The bell is a regular 2½-inch bell; the plunger is connected with flexible cords, the two ends of the cords being inserted directly into the binding posts of the bell.

In order to control a window, as shown in the figure, the



ST. JAMES BURGLAR ALARM, ATTACHED TO A WINDOW.

small wooden block is pressed against the frame, being provided with two pins which enter the wood, the box containing the batteries and to which the bell is fastened being set on a table or mantel near the window. The plunger is put into the cylinder to the marked point and the small chain attached to the window sash by means of the thumb tack and chain; if the window is raised, the plunger is withdrawn, the springs making contact on the inside which throws the current from the battery through the bell.

To control a door, the small block or cylinder is pressed into the side of the box and the entire apparatus placed on the floor in front of the door as shown. The opening of the door forces the plunger into the cylinder, the springs making contact on the metal portion of the plunger throwing the current of the battery through the bell. The cylinder piston and cords all fit into the top of the box, so that when not in use it occupies only the space the size of the box.

This appliance is to be known as an electric portable burglar alarm and will be on the market about Oct. 15; they will be sold at $2 each retail and $1.50 wholesale. Mr. Eidlitz will be pleased to furnish any further information.

The Use of Electricity in the Spanish-American War.[1]

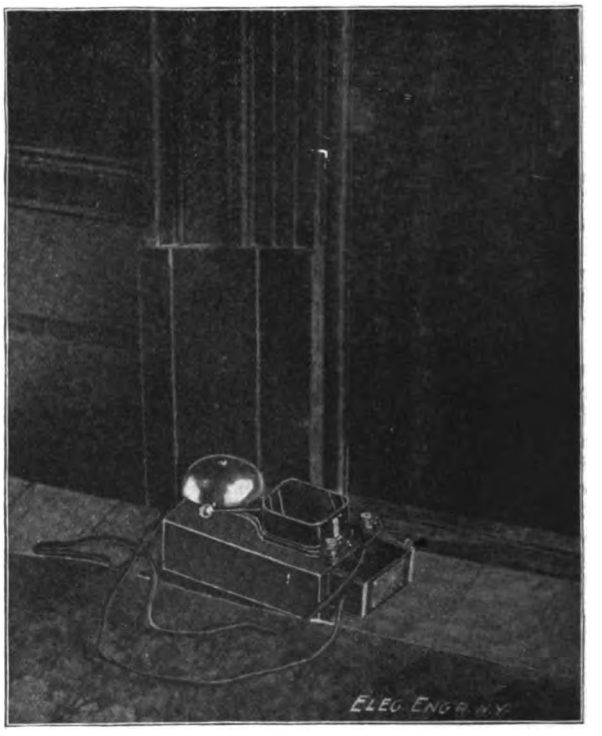
BY THOS. G. GRIER.

THE application of electricity in the Army and Navy for its various and many purposes is recent, but its progress is rapid. The object of this paper is more to note the uses than to describe the details.

The fortification board established ten years ago by the United States Government has developed complete and elaborate plans for the equipment of coast fortifications.

To condense as much as possible, a brief summary of the applications can be given by describing the methods employed at Fort Wadsworth, which lies just below New York City. In this fort the fire commander directs the attack from a sheltered station equipped with a Lewis range finder. There is also a position finder station and four battery commander stations. The fire commander is in direct communication with all by means of telephones.

In the position finder's station, together with numerous other instruments, is a dial telegraph, electric clock and telephone. One of the guns is equipped with a dial telegraph and another with a Sheehy teleotype, an instrument which indicates the



ST. JAMES BURGLAR ALARM IN POSITION TO CONTROL DOOR.

azimuth or angle from a predetermined line and gives the range or distance in yards the observed vessel is from the fort. All of the commanders' stations are, however, connected with the guns both by speaking tubes and telephones.

Observations are signaled to the guns, and the course and speed of a ship are plotted upon a miniature representation of the harbor. By means of an electric clock placed at every station absolute uniformity of time is obtained, and the probable course and range of a vessel for several minutes can be plotted from these observations, and without even seeing the vessel the gun can be elevated for the range and trained for the proper angle, and by means of a stop watch the order to fire given so that the shot will fall upon the deck of a vessel whose course has been observed by men at a distance from the guns. The

[1]Read before Chicago Electrical Association, Oct. 7, 1898. Abstract.

Digitized by Google

introduction of electricity for signaling has given this wonderful control to the fire commander over his batteries.

Sandy Hook, at the mouth of the harbor, is connected by cable with Fort Wadsworth, and the approach of hostile ships may be telegraphed to the fire commander so that their course may be watched and the fort prepared at the proper time to do justice to the work before them.

Sandy Hook was placed in telephone communication also with Washington during this summer, so that the Government was in position to receive or send messages to the fortifications. Fort Wadsworth has two 60,000 candle power searchlights to sweep the harbor and guard against the approach of vessels on dark and stormy nights. An electric light and power plant forms a portion of the outfit with a reserve storage battery to supplement the power station.

The channel above the fort is mined, and should some of the vessels of a hostile fleet pass the guns of the fort, the observer at the submarine station would be plotting the course of nearby ships, by means of range finders or by information furnished them by the fort, and at the proper time fire the mine and sink the remnant of the fleet.

The mining of the harbors was an important part of our coast defences, and the greatest demand for electrical wires and cables was for "torpedo cables" for use in submarine mines. There are two styles of cables used, a multiple cable of seven conductors which is used to connect the shore end to a junction box in the channel, and a single conductor cable which connects each conductor in the multiple cable to an independent mine, each con-

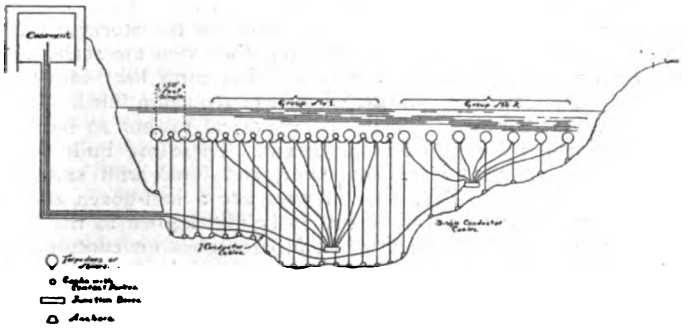


DIAGRAM OF MINES IN BOSTON HARBOR.

ductor being numbered. Any mine may be exploded at will from the shore.

When war was declared each of the manufacturers of submarine cable in this country received orders for all they could make in thirty days, and some were kept busy for sixty days, producing, probably, two hundred miles of multiple cable and two hundred miles of the single conductor. This has been distributed from the Bay of Fundy to Florida. Some was sent to the gulf cities and some to California, Oregon and Washington. One hundred and fifty miles of each size was under contract in the early part of August. The cost of seven-conductor cable averages about $1,900 per mile, and the single conductor about $450 per mile.

Headquarters for work on submarine mines are at "Torpedo Station," Willets Point, Tory Island, with Maj. John D. Wright in charge.

SUBMARINE MINES.

There are three different kinds of mines used in our harbor defence.

First—Observation mines, which are fired from shore when a ship is judged, by observation, to be within effective range of the explosive.

Second—Automatic mines, which are self-firing on being struck by a vessel.

Third—Electrical contact mines, which, on being struck by a ship, give notice on shore, and the operator, by the throw of a switch, fires the mines.

The method of firing observation mines and electrical contact mines are similar. Automatic mines may or may not be fired by electrical means.

Mines may be placed upon the bottom of the harbor, and in such cases are called ground mines, and if they are contact mines the contact mechanism is contained in small buoys anchored at a depth below low-water mark just sufficient for them to be an obstruction in the path of vessels. When the channel is deep, buoyant or floating mines are used. A buoyant mine is more effective, as it lies nearer the object of attack, and for an equal effect does not require as large a charge of explosive.

MINES IN BOSTON HARBOR.

The shape and material of mines or mine cases are various, and the kinds employed at different points not always identical. However, a general description of the mines employed in Boston harbor will give a good idea of the plan and design used in all other harbors.

There were about one thousand mines planted in Boston harbor, covering the main ship channel and ingress to the harbor where vessels of over 12-foot draft could go at low water. The regular Government mine consists of an upright iron cylinder about the shape of a top, with a strap on the bottom for holding the cable. Galvanized steel rope secured by an anchorage of any kind, and in many cases of old horsecar rails, maintained the mines in position. The cable containing the electric wires runs up separately from the cable holding down the mines.

As the demand was urgent and no mines of the Government pattern were to be had, the engineers in Boston used new ale barrels, a hole being bored in one end for the receipt of the contact mechanism and cable. The barrels were encircled with rope to make a sling to hold them down, a flat steel ring put around the rope so that the steel anchor cable attached to it would not cut through. These mines were of different sizes and held from 100 to 500 pounds of explosive gelatin. Ordinary dynamite was used in some mines where there was not enough gelatin to be obtained. This was put in through a small hole in the top where the electric contact mechanism is placed.

The contact mechanism is connected through high resistance and by a battery circuit, using the cable and ground return for its conductors to an indicating and circuit-closing device located in the protected casement on shore. When a ship strikes a mine containing the device, deflecting the mine from its normal position, the battery circuit is closed; this operates an indicating mechanism which closes a break in the dynamo circuit and notifies the operator. To throw on the current for exploding a mine it is necessary to throw in a switch or plug after the first break is closed by the indicating device. This circuit can be closed without any contact from the vessel at the will of the officer in the casement.

The firing switchboards at Boston consisted of an ordinary knife switch suitable to take 500 volts, with a spring which holds it out of contact at all times except when kept in position by the operator. These switches, one for every group of mines, were mounted on slate boards and plainly numbered with large letters. A dynamo developing one ampere at 500 volts, driven by an oil engine, furnished the exploding current.

The contact devices were made part by the Anchor Electric Company and part by the General Electric Company, the design being that of the Government with several alterations made by Dr. Louis Bell, the engineer in charge for the Government, to shorten the time of manufacture. All of the parts of the contacting mechanism were of platinum or gold-plated brass to prevent any possibility of corrosion. The exploder consisted of a thin strip of platinum wire which was laid in a case of fulminate, which in turn was put in a case of dry guncotton; the remainder of the explosive was wet.

The mines were usually placed in groups of seven each, about 150 feet apart, as shown in the figure. These groups of mines in Boston harbor were strung clear across the channel and in the main channel there were three lines.

In this method, should a vessel be sunk by the first line of mines and the wreck not obstruct the passage for other vessels, the second line of mines would catch the next vessel and the third line the third vessel. Between the mines were small casks with contacting devices connected to mines on either side. These were cheaper than mines, but were equally serviceable and made the line complete, so that no vessel could get through.

Our army in the field has its cable tents completely equipped with telephones and telegraph instruments. The telephone at Santiago and adjacent points before and after the siege was of great service, and cable tents now have their names lengthened into the title of cable and telephone tents.

The signaling and indicating devices used on vessels are: "Helm indicators," "steering telegraphers," "speed indicator," "direction indicator," "range indicating system," "Fiske range finder," "azimuth telegraph" and "transmitter of orders." All of the devices consist of galvanometers, which indicate on their

Digitized by Google

dials a difference of pressure, the dials being marked for the different offices the instruments perform, and with each instrument or system of instruments proper devices are used for altering resistances and consequently changing pressures to accomplish the ends in view.

The steering telegraph is an arrangement of galvanometers, with a device for altering the resistance by hand. The captain sets the resistance from his station, having an instrument before him. The same indication appears upon an instrument in the wheelhouse, and by noting the helm indicator the captain is advised when his order is obeyed. The same thing is true of the engine telegraph, the transmitter for orders and the azimuth telegraph.

In the Fiske range finder, described in The Electrical Engineer at various times, the general principle is the measurement of the resistance of a conductor in the form of a Wheatstone bridge, there being two arcs of wire at the ends of a base line, corresponding to two contiguous members of the bridge. Two telescopes are located at the ends of the base line and carry contacts which move over the resistance wire as the telescopes are turned to be pointed upon any object.

The speed indicator is in reality a small alternating current dynamo, the current being great or small according to the speed of the shaft, and the strength of the current indicating upon an alternating current galvanometer graduated in revolutions per minute. Six soft iron cores or inductors fastened to an iron ring on the shaft form the armature. These are rotated, the pole of a north and south magnet having two coils of wire at its extremities, the coils of wire being connected in series with the galvanometer.

The direction indicator simply tells in which direction the shaft is turning. A permanent magnet fastened to a ring on the shaft revolves in front of a soft iron bar, around which is a coil of wire that is connected to a galvanometer. The shaft revolving in one direction throws the pointer to one side, and when its direction is reversed throws it to the other side.

Jones & Laughlin Co., Ltd., and the Production of Steel.—I.

WHILE there are a bewildering number of blast furnaces, rolling mills and metal working establishments in and about Pittsburg, there are only a few firms that conduct the steel business through all its stages from the ore to the marketable or finished product, such as Jones & Laughlin, Ltd. The increasing demand for metal structural material for electrical power houses, as well as for machine shops and car stations, and, in fact, for all classes of buildings, prompts the inquiry as to how it is possible to produce this material so cheaply that it is superseding wood and other materials for building purposes, and makes the steel industry closely allied to the electrical industry, and more especially as this metal enters largely, not only into the buildings in which electrical machines are housed, but constitutes the vital parts of these very machines themselves. Again, the growing employment of electric power for operating many of the mill appliances serves as another and closer bond between the two industries.

We are accustomed to say that the old has given way to the new in many industries, and cite the horse car and gas light as things of the past, but the changes in the iron industry have been just as striking. Where are the puddling furnaces of the past? and what has wrested the puddling hook from the grasp of the heated mill man, and rendered his trade obsolete? The celebrated steel formula of Sir Henry Bessemer, the discovery of steel ore in the Mesaba range, the demands of the times, and the introduction of machinery to move the mill products promptly, and to work them at once into marketable shape, have made the change.

BLAST FURNACES.

The plants of this company occupy about seventy acres, lying on both sides of the Monongahela River, a few miles above its junction with the Allegheny, but well within the limits of Pittsburg, and although all the modern economical methods known to the trade are employed, a force of over five thousand men are required to operate the various plants. The metal work begins with the blast furnaces and coke ovens, which occupy that portion of the tract which lies south of the river. Here the ore, the coal, the limestone, the silicates are delivered. This particular grade of ore has the appearance of a fine reddish sand, and was mined in the Mesaba range on the shores of Lake Superior, shipped down the chain of lakes to Cleveland, from which place it has journeyed by rail, and was finally dumped in great piles near the foot of the three furnaces which comprise the plant, and are known as the Eliza furnaces. The limestone has come by rail from near Martinsburg, W. Va. The silicate in the form of gravel from the river bed, and the coal, have been delivered in barges from the neighboring mines that have given this region its prominence as a manufacturing centre.

The first process consists in coking the coal, or one might say in cooking the coal, and for this purpose 600 coke ovens have been constructed in the neighborhood of the furnaces. These are built in long rows and the ovens in each row are connected by longitudinal, tubular smoke flues that rest on top of the ovens and lead the smoke and fumes into iron smokestacks that are about 100 feet in height, and serve to elevate the smoke so that it does not settle so disagreeably about the neighboring buildings and dwellings. The ovens are charged at the top by means of iron cars, which are drawn by a small locomotive that plies up and down, amid the escaping heat and smoke. Each oven has a capacity of about five and one-half tons, and it requires about forty-eight hours to coke a charge properly, when the product is removed from side doors, and after cooling is shoveled directly into cars, and carried to the storage piles near the furnaces. After being emptied, the ovens are sealed up for a short time, or until sufficient heat has come back into the walls to ignite the new charge, when they are again filled.

The furnaces proper consist of cylindrical towers 20 feet in diameter and about 100 feet in height. These are built with metal shells, painted a reddish color, and lined with suitable fireproof material. Near the furnaces are a half-dozen other dome-like structures about 80 feet in height, known as the hot blast retorts. On being started, a furnace goes on continually night and day, Sundays and holidays, or until it is shut down for repairs or rebuilding.

We are now ready to follow the ore and coke to the mouth or top of one of the furnaces. It is first shoveled into hand carts or large barrows, and rolled on to the platform of an elevator, which is sufficiently large to accommodate two or three carts at a time, with occasionally a load of limestone, as about 2 per cent. by weight of the charge consists of this material; and now and then a load of gravel, which, in some way, it is said, facilitates the separation of the slag from the metal. On being lifted to the top, the carts are run off and dumped into what is known as the bell, an arrangement by means of which the ore is lowered into the furnace and dumped without allowing the flame and smoke to escape. The products of combustion are collected in a large flue, which leads in a slanting direction from the top of the furnace to the ground, where it divides into numerous branches, some being led along the base of the hot blast retort, others to the fire boxes of the steam boilers, where the gas reignites and serves as fuel for generating steam, only a very small portion of coal being required in addition as fuel under the boilers. But what is the use of steam? This reminds us that we have overlooked an important element in the charge, that of air for combustion, so we will step into the engine room near by, and here we find six vertical engines, running at a high speed, with double flywheels, having cylinders 60 x 84 inches, and each rated at 1,500 h. p. The piston rod of each is extended to a second cylinder, also 84 inches in diameter, placed above the steam cylinder, and which serves as an air compressor for supplying the blast, at about 12 pounds pressure per square inch, and because of which the name "blast furnace" is applied. There is also a second engine house in which a blast is generated for one of the smaller furnaces. There are two horizontal engines with cylinders 72 x 84 inches, and a compressor of the same diameter, operated by an extension of the piston. There is also a small electrical plant with power and arc light generators, from the current of which the plant is lighted, and the electrical cranes are operated. This blast is led first to the heating retort, through which it passes, and is delivered through tuyeres all around the base of the furnace at a temperature of about 1,100 degrees. These retorts are first heated by direct-

Digitized by Google

ing into them at the base a portion of the furnace gases through pipes and valves above described. These gases on being freed and brought in contact with the air, ignite with a roaring sound, and serve to raise to a white heat the lining of the retorts, and the baffling bars that are placed in the flues, which lead to the top, and return to the base, from which the smoke escapes to pipes connecting with the smokestack. When a retort is sufficiently hot, a process that requires about two hours, the fuel supply pipes are closed, and the valves of the air pipes leading from the compressors are opened, and the blast is directed for an hour in the same manner through the heated flue, taking up the heat, when it is delivered at a high temperature as above described, to the furnace. Each furnace is provided with three heating retorts, which are alternately operated and so deliver a continuous hot blast to the contents of the furnace, by which process the heat is economized to a marked degree. The molten metal is drawn off six times in twenty-four hours, and is molded into pigs; the capacity of the largest furnace being 600 tons of metal per day of twenty-four hours. There are two outlets near the bottom of the furnace, one being a little above the other. From the upper one, the slag is first drawn off, and after cooling it is loaded into iron cars and hauled away to the waste pipe. The metal is then drawn and cast into pigs, two methods being employed. By the old method, and one which is still followed to some extent, the metal is caused to run into open sand molds, systematically laid off on the sand floor, in front of the furnace, and when sufficiently cool, the pigs are removed and taken to the storage yards.

The latest and most economical method for molding pig iron consists in first drawing the contents of the furnace into large ladles, which are mounted on iron cars, and are hauled for some distance to the molding shed, where the metal is poured into a small hopper beside the track, one man only being required to manipulate the ladle. From this hopper the metal runs in a continuous stream into the buckets composing an endless chain, which extends about 150 feet at right angles to the track, being slightly inclined. The individual buckets are V-shaped, and about two feet in length. Near the upper end of the conveyor a spraying device is located, from which water is led onto the metal in passing, hastening the cooling, so that when the end of the line is reached, the metal is solid, and as the buckets or molds descend over the driving wheel, an automatic sledge hits each pig, dislodging it from the bucket, when it slides over an incline, directly into open freight cars ready for transportation, streams of water being directed upon the mass during the process of loading. The conveyor is operated by an engine located near the upper end of the incline, and the buckets, as they return dip into a tank containing a liquid preparation of lime and clay, by means of which they are coated by a material that prevents the molten metal from adhering to the molds. It may be readily seen that this method avoids the necessity for handling the metal so many times, as is required by the old process, while it leaves the pigs smooth and free from sand, and the workmen are not exposed to the excessive heat that is an accompaniment of the floor process of molding.

We are now ready to follow our pigs over the bridge across the river to the Bessemer furnaces and rolling mills, but before we make the trip, we pause to note that extensive improvements are going on in the track arrangements near the end of the bridge, which are designed to facilitate the handling of the ore and coke. These improvements consist of seven elevated track structures, to the columns of which extensive storage bins are attached, into which incoming cars will discharge their loads of ore and coke, and from which the material can be drawn into other cars running on a lower line of track, but which by an inclined road can be run to the top of the furnaces, where they will discharge directly into the bells, and so avoid the necessity of shovels, hand carts and elevators.

The bridge connecting the two departments of the works is owned by the Monongahela Connecting Railroad Co., which company is a connecting link between the two concerns, although composed of the same parties, and operates the cars in and about the grounds. On crossing the bridge we note as we near the north end, a vertical coal conveyor, which scoops the coal from the barges lying in the river below, and delivers it into small trolley cars, which are operated by electric power over an elevated structure, and delivers it to the gas making machinery, which constitutes an important adjunct to the rolling mill equipment. We also note on the right, below the bridge, an enormous cantilever crane about 40 feet in height, and with a reach of 150 feet, by means of which ingots, rolls, buckets of pig or other heavy material, can be lifted and passed over the railroad track to or from the mills, and the storage yard, located on the bank of the river, where we also find great piles of metal in the pig waiting to be converted into steel and its various useful forms.

SOCIETY & CLUB NOTES

National Electrical Credit Association.

On Oct. 7, the delegates of the various electrical credit associations met at Cincinnati, O., at the Burnett House, and formed a National Electrical Credit Association. A constitution and by-laws were adopted governing the business policy of the body. The board of managers consists of one member of each local society. It is the purpose of the national body to issue a monthly list of delinquents and to furnish other valuable information that will be of interest and value to the constituent members all over the country. As the Association grows stronger, it is the hope and purpose to establish a credit bureau, whereby it can keep all members accurately and thoroughly posted as to all buyers of electrical goods. It is believed that the Association by thus solidifying and developing the work of the local electrical trade societies will be of incalculable benefit to the trade and industry as a whole.

LEGAL NOTES

Climax Boiler Patents Sustained.—Thos. F. Morrin and the Clonbrock Steam Boiler Co., vs. Thos. J. Lawler and the Edison Elec. Illum. Co., of Brooklyn.

JUDGE J. THOMAS, of the United States Circuit Court, Eastern District of New York, at a final hearing of the cases of Thomas F. Morrin vs. Thos. J. Lawler and Thos. F. Morrin and the Clonbrock Steam Boiler Co. vs. Edison Electric Illuminating Co., of Brooklyn, rendered the opinion that the defendants have infringed the rights secured to the complainants by Patent 309,727, which deals with the general construction of the "Climax Boiler" and the first and second claim of Patent 463,307, as to the tubes, and the improvements in sectional casings secured to the complainant by Patent 463,308.

The characteristics of the Climax boiler claimed as original by Mr. Morrin, and which have now been strongly upheld by the Court, are as follows:

1. The radial tubes are to be heated by an annular grate surrounding an upright generating cylinder. 2. The tubes are arranged so that the upper branches of one tier overlap and enter the cylinder above the lower branches of the next tier above. 3. The tubes are set obliquely to the axis of the generator cylinder. 4. The tubes extend to an equal extent in the generator cylinder. 5. The tubes are of the ogee form.

Pursuant to the opinion of the Court decrees will be prepared and settled upon the usual notice. Messrs. Arthur von Briesen and Daniel O'Connell appeared for the complainants and Messrs. Frank R. Lawrence and Edwin H. Brown for the defendants.

New Motive Powers on Street Railroads.

The Babylon Railroad Company, which operates a railroad through the streets of the village of Babylon, Long Island, is authorized by special act to operate such road "by horses, mules or dummy engines." The Board of Railroad Commissioners denied the company's application for permission to change its motive power from horses to kinetic stored steam power. The Third Appellate Division, on writ of certiorari, reversed the de-

Digitized by Google

termination of the Commissioners, holding that it was not a valid objection that a kinetic power was "a locomotive steam power," the use of which is prohibited by Section 100 of the railroad law. The Court held that the board was not required by statute to withhold its approval of such an application because the motor proposed to be used is still in its experimental stages or because the corporation applying to use it is controlled by persons interested in such motor system. The action of the board in determining such a question was held to be judicial.

REPORTS OF COMPANIES

Narragansett Electric Lighting Co.

An important meeting of the stockholders of the Narragansett Electric Lighting Company was held on Oct. 8; 80 per cent. of the stock being represented by actual holders in person. The first vote was in acceptance of the provisions of the amendment of the charter passed at the last Newport session of the Legislature, whereby the capital stock was increased from $2,000,000 to $4,000,000. Of the originally authorized stock $1,200,000 has been issued.

The second vote was to issue convertible debenture certificates of stock for the whole or any part of the new $2,000,000. The third vote was to issue $800,000 worth of stock to bring the amount up to the limit of the first $2,000,000, and to authorize the directory to issue the second $2,000,000 when in their judgment it becomes essential to do so. Every stockholder holding two or more shares is by vote entitled to have the privilege of subscribing to the debenture stock before the books are opened to outsiders.

Annual Figures of Western Union.

President Eckert, in his annual report, states that the capital stock outstanding of the Western Union Telegraph Co. is $97,370,000, of which $28,850.35 belongs to and is in the treasury of the company. The bonded debt, less balance of sinking fund appropriations not yet used for redemption of bonds, is $14,858,875.52.

The net revenues, expenses and profits of the year ended June 30, 1898, were: Revenues, $23,915,732.78; expenses, $17,825,581.52. Total, $6,090,151.26.

From this there was applied for dividends, interest on bonds and sinking fund appropriations, $5,774,457.20, deducting which there was a surplus of $7,983,235.12.

The report shows an increase of 33,418 miles of wire and of 441 offices. The number of messages transmitted during the year was 4,022,065 more than the preceding year, and the increase of revenues for the same period was $1,276,873.62 over the year before. The average tolls received were 30.1 cents per message and the average cost per message was 24.7 cents. The cost of construction of new property for the year was $1,117,651.61. The surplus account was increased $315,694.

James Stillman, president of the National City Bank, was elected a director of the company at the annual meeting of the stockholders. He takes the place in the board made vacant by the death of Roswell G. Rolston, for many years president of the Farmers' Loan and Trust Company.

PERSONAL

PROF. W. M. STINE, formerly of the Armour Institute, Chicago, has taken this fall the chair of Engineering at Swarthmore College, Pa. It is to be hoped he will not relax his devotion to special electrical researches.

MR. C. E. WHITE, of Philadelphia, has been elected manager of the Municipal Gas and Electric Light Works at Wakefield, Mass.

MR. H. A. SINCLAIR, of the Tucker Electrical Construction Co., and treasurer of the New York Electrical Society, is just convalescing from a very severe attack of intermittent fever. His recovery is greeted with much pleasure by a wide circle of friends, who have learned to esteem highly his modest, manly character and high, conscientious ideal of duty.

MR. HORATIO A. FOSTER, the electrical expert of Buffalo, was in New York last week and spoke interestingly of the power transmission work there and other developments. His new "Pocket Book" for electrical engineers will soon be out.

MARRIED

Sykes—Sanborn.

Mr. Frederick G. Sykes, Electrical Superintendent of the Edison Electric Illuminating Co., of Brooklyn, was married at high noon, Tuesday, Oct. 11, to Miss Neva E. Sanborn at Brentwood, N. H. Mr. Sykes is a graduate of Lehigh University, class of '94, and before filling his present position, was connected with the Engineering Department of the General Electric Co. at Schenectady.

Cooley-Bogart.

Mr. Maxwell S. Cooley, of Dannemora, N. Y., was married on Oct. 17 to Miss Grace C. Bogart, of Elmira, at the home of the bride. The wedding was a very quiet one, only the immediate family being present. The ceremony was performed by the Rev. George H. McKnight, pastor of Trinity Church. After a short wedding trip, Mr. and Mrs. Cooley will leave for Dannemora, N. Y., their future home, where Mr. Cooley is engaged as the electrical engineer and electrician of Clinton Prison. Mr. Cooley is a graduate of Cornell, class of '96.

Wheeler—Sutton.

The wedding took place on Oct. 11, 1898, at Rye, N. Y., of Dr. S. S. Wheeler, president of Crocker-Wheeler Electric Co., to Amy, daughter of Mr. and Mrs. John Joseph Sutton, of that place. The wedding ceremony was performed at the family residence by the Rev. J. E. Bushnell, assisted by the Rev. Dr. G. W. Knox. There was a large gathering of friends, many of whom went from New York city in a special car attached to the noon train. There were several men well known in electrical circles in the party. Mr. Gano S. Dunn, E. E., was best man. After the wedding breakfast, Dr. and Mrs. Wheeler left for the East, and on their return they will occupy a house in the Murray Hill district of this city.

THE STOCK MARKET

One Eye on the Elections.

IT seems a pity to have the course of reviving business interrupted by the elections that are coming along, but they are inevitable, and the disturbance this "off" year is not very sharply marked. The bank clearings, railroad earnings and business failures all show a good state of affairs, while the cooler weather is nipping in the bud the outbreak of yellow fever down South. The iron and steel output continues large, and the demand for cereals has been very heavy. There is general activity in the machinery trades. Gold has been coming this way in good volume, and Government bonds have made new records.

In Wall Street the strenuous speculation in Sugar and Tobacco have continued with demoralizing effect, but although the public has been indifferent the market has remained steady and strong. During the week 4,560 shares of Western Union were sold, up to 91⅜. On sales of 2,060 shares, General Electric went off slightly to 79. New York Edison was steady at 121, and Metropolitan Street Railway sold from 165 to 162⅜. In Boston, American Bell Telephone went off slightly to 278.

Copper last week, New York, sold at 12¼ cents. Heavy steel rail, Eastern mill, is $18.

Digitized by Google

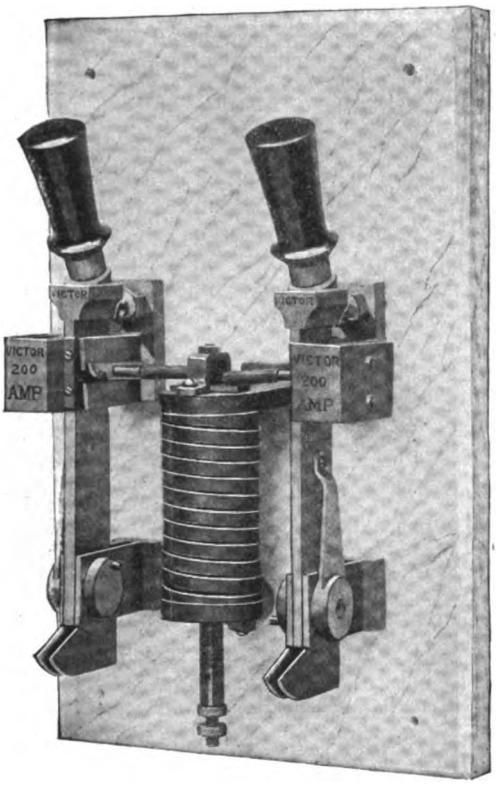
TRADE NOTES AND NOVELTIES

The "Victor" Circuit Breaker.

BELOW we illustrate a new circuit breaker which has been on the market for several months, and has been used on some of the largest installations in New York City. It is worthy of mention, owing to the many advantages claimed for it, over other circuit breakers, and its many new and novel features which are embodied in the construction of the instrument. The action is also new and radically different from other instruments on the market.

This circuit breaker is manufactured by the firm of F. A. LaRoche & Co., 13th and Hudson streets, New York City, who are also the manufacturers and owners of the "Ideal" circuit breaker, which has been described in the Engineer. They also manufacture a full line of switches, switchboards, and all kinds of automatic switching devices.

The new circuit breaker's trade name is "Victor," and the name is a very appropriate and deserved one. The style of this



"VICTOR" 200 AMP. AUTOMATIC CIRCUIT BREAKER.

circuit breaker is of the fly-out action, but the danger to the operator is reduced to a minimum owing to the shortness of the blades, and the momentum being checked or broken as soon as the circuit is interrupted.

They are made with independent action, that is to say, that each blade is separately thrown in and controlled, and in case of a short circuit or over load, both blades simultaneously open up; the action in that respect being similar to the well known "Ideal" circuit breaker, which was the first circuit breaker put on the market with this novel feature.

Neither the "Victor" nor the "Ideal" circuit breaker can be closed as long as the over load or short circuit exists in the line. As soon as one blade is thrown in, and an attempt is made to throw the opposite blade in, the blade already in the clips will open up simultaneously on the blade being closed, thereby making it unnecessary to use knife switches in conjunction with these circuit breakers.

Each blade has a separate latch and catch which acts on the roller principle, reducing the friction to a minimum. Also each blade is independently hinged on a self-locking hinge post, which by the act of closing the blade compresses the clips of the hinge post, and which can be depressed to any degree, as this locking device is graduated, and is adjustable, and can be set with a pressure of 1,000 pounds to the square inch of pressure between the clips and blades, therefore always making that a solid mass of copper.

It has never yet been known for any of these breakers to heat at the hinge post with double the amount of current going through above the normal. The breaker is equipped with new style carbon breaks of liberal capacity, so adjusted that the blades have left the conducting clips one inch before the break taking place on the carbon, therefore preventing burning of the clips, freezing and cutting, which so often causes trouble with switches and circuit breakers.

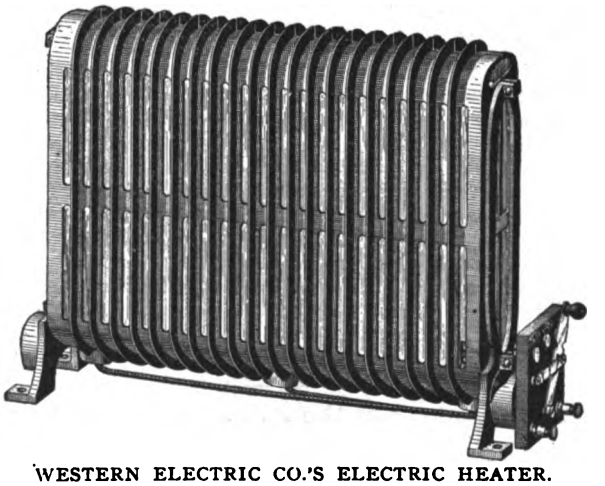
The solenoid is differentially wound, which concentrates the force to the hole of the solenoid, very little current passing through the outer coil. The coils on the circuit breakers from 100 amperes up, are wound with bare copper and carefully insulated, yet when the coil is completed, it looks like one solid spiral of copper. It is one of the neatest methods employed in making coils for automatic switches. The entire circuit breaker is made up of cold, hard drawn copper, no castings being used throughout its entire construction. The whole conducting part of this circuit breaker is calculated on a basis of 750 amperes to the square inch sectional area.

Each blade has an independent plunger and copper steel spring, which can be removed if required from the front or back of the board, as may be desired.

Another advantage claimed for this circuit breaker is the few number of holes that need be drilled in the switchboard; only seven holes being required to hold the circuit breaker in place and on the board. The range of adjustment is large, namely, a circuit breaker with a normal rating of 200 amperes, can be adjusted to break a circuit anywhere between 100 amperes and 400 amperes. They are also made with under load attachment. Every one of these circuit breakers is carefully and accurately calibrated, and is said to be as reliable as any amperemeter on the market.

Western Electric Heater.

THE electric heater has a wide field of application in heating small offices, bathrooms, snuggeries, cold corners of rooms, street railway waiting rooms, the summer villa on cool evenings and in mild climates has still a wider range. It has the peculiar advantage of being instantly available and the amount of heat is regulated at will. The heaters are perfectly clean, do not vitiate the atmosphere and are portable. No definite rule can be given to determine the amount of electricity necessary for heating a given space, though approximate estimates can be made



WESTERN ELECTRIC CO.'S ELECTRIC HEATER.

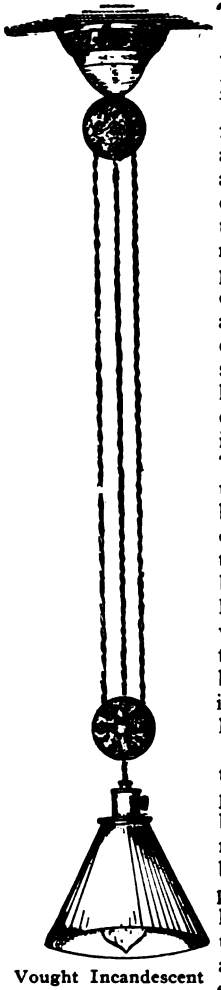
by allowing from 1 to 2 watts for each cubic foot of air space to be heated, the latter amount for well constructed buildings in cold weather or for quickly heating a bath room. The electric heater is extremely valuable in the late spring when furnace fires are not in use and a sudden raw spell comes on, as the electric current is immediately available and takes the chill from the room at a minimum expense and trouble.

Digitized by Google

The Western Electric Company's heater, made in the shape of a small steam radiator, is 14½ inches long, 3⅜ inches thick, stands 12½ inches high and is finished in black enamel or Japan. It is made for two adjustments, half capacity and full capacity. The switch indicates when the current is off, when half of the heater is used and when it is all in use.

The heater is made for 52 and 104 volts, suitable for alternating currents, and also for 110 and 220 volts, to be used on direct current circuits.

The Vought Incandescent Lamp Hanger.



Vought Incandescent Lamp Hanger.

THE accompanying illustration shows a type of incandescent lamp hanger which was placed on the market about a year ago by Mr. M. I. Vought, La Crosse, Wis., and of which thousands are in satisfactory daily use. The hanger, which is automatic, convenient, simple, neat, durable, cheap and practical, is made in different grades and sizes. In the cheaper styles the upper ball is turned of wood, having a recess one side of centre, in which is a pulley of hard fibre. On the opposite side of centre a hole passes through the ball in a slanting direction from a point in the centre of the upper surface to a point one side of the centre of the lower surface. The lower ball is cast metal, for counterweight effect, having a recess just above the centre, in which is a grooved pulley of hard fibre. The cord passes down through the hole in upper ball, down around pulley in lower ball, up around pulley in upper ball and down to socket. The cord does not pass through the lower ball in going to socket, but is left to swing free, thus allowing the light to be carried to any point of angle without being incumbered by the counterweight. The cord between the upper ball and rosette serves as a swivel, allowing one to walk around the room with the light.

The principles for the brass finishes are the same as the cheaper finishes. The upper ball is hollow, the hole passing through being bushed above and below with common socket bushings, so that in case one is broken or destroyed, it may be easily replaced. The walls of the recess are made of hard fibre. When used with a canopy, the upper bushing is removed, and in its place an ⅛-inch gas pipe nipple is screwed, one end attaching to the crowfoot under the canopy in the usual manner.

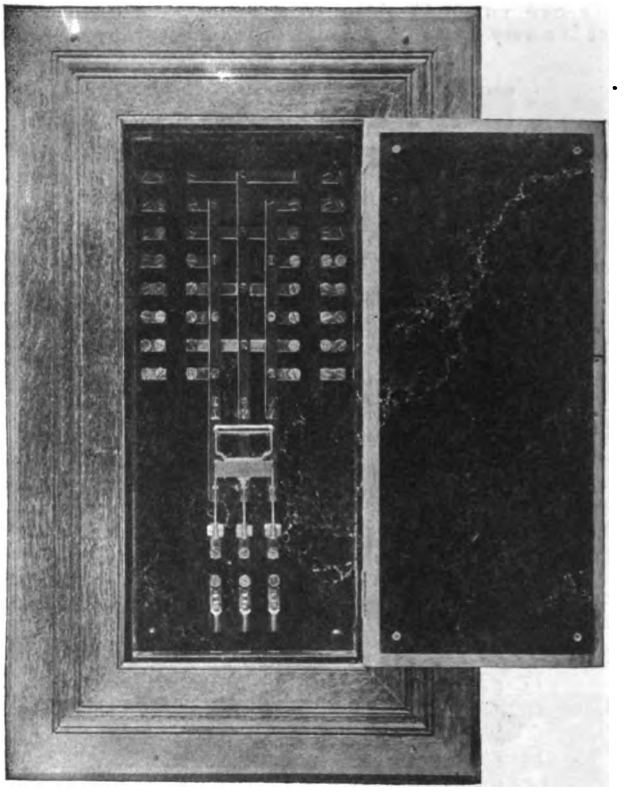
The "Handy Attachment" is simply a revolving shuttle, to which is attached an insulating hook to catch the lamp cord, the shuttle being wound with about ten feet of line, to the free end of which is fastened a fine pointed hook, which permits of its being fastened to a window casing, picture moulding, pigeon hole of a desk, etc. The illustration shows the hanger in fancy style, with canopy to match. This may also be used if desired with a common rosette, attachment plug, or with a bracket. This style is finished in polished brass, nickel plate or oxidized. The article may be highly recommended for offices, reading rooms, public libraries, clubrooms, homes, schools, colleges, printing offices and shops. A neat little pamphlet is issued by Mr. Vought giving further details of this very useful article.

American Stokers at the Arbuckle Sugar Refinery.

On approaching the buildings of the Arbuckle Sugar Refinery, Brooklyn, N. Y., a chimney becomes visible, but, to one's surprise, no smoke can be seen, and it would appear at first glance that the plant was not running, but if one should inquire as to the cause of this absence of smoke, it would be found that American stokers have been installed in these buildings. Forty-six furnace fires (of necessity forced at times) burning soft coal, all forty-six furnaces connected with or emptying in a single stack, from which not a bit of smoke issues, is ample evidence of the ability of the American stoker to prevent smoke, and to secure the very highest efficiency in the use of cheap soft coal. The engineer, Mr. Everett when asked what was responsible for the absence of smoke from the chimney, granted the following information: "Up to a few days ago eight fire boxes were being fed with the sugar cane leaves and wrappings, as the city will not permit us to dump them near here, and the matter of their disposal has become quite a serious question. These wet leaves and wrappings were fed into the furnace by the use of pitchforks, and as they contained more or less sugar, emitted a heavy black smoke. Now that they are no longer to be burned, I don't think you will see any smoke from the big chimney."

Zimdars & Hunt Panel Board.

NOT the least of the many new and improved appliances that have contributed toward bringing the modern installation up to the high state of efficiency that it has attained is the modern slate, or marble cut-out, or panel board. So rapid has been the development of these articles, they have, it is said, now practically displaced porcelain cut-outs in all first class work. The firm of Zimdars & Hunt, 127 Fifth avenue, New York,



ZIMDARS & HUNT PANEL BOARD.

were early in the field as manufacturers of these boards, and they have been tireless in their efforts to bring them to their present state of efficiency. One of the results of their labors has been the cataloguing of the principal types and the compilation of tables of dimensions. These are given in their new General Catalogue, just issued, together with complete price lists of all types. This catalogue is profusely illustrated, and contains a great deal of useful information regarding these articles. It should prove a valuable acquisition to the office library of any contractor. It can be obtained upon application by addressing the above firm.

Third Avenue, N. Y., Trolley Contracts.

It is stated that the Third Avenue Railroad has now let contracts for the electrical equipment, etc., of its lines. The Westinghouse Co. will, it is said, carry out an order for $4,500,000 of apparatus. The National Conduit & Cable Co. will do underground work to the value of $1,500,000. The Johnson Co. is to furnish 15,000 tons of 110-pound rail and the Pennsylvania Iron Co. 3,500,000 castings for the conduit.

Digitized by Google

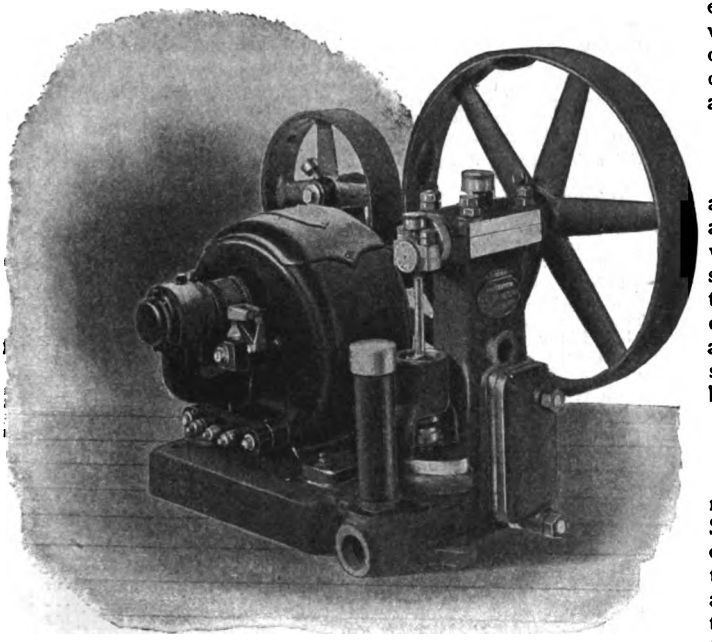
Jandus Enclosed Arcs in Boston.

Mr. H. T. Edgar, manager of the New England office of the Jandus Electric Co., informs us that their enclosed arcs are to be installed in the new Boston Terminal Station, which when completed will be the largest in the world. The lamp was selected by Westinghouse, Church, Kerr & Co., who are installing the entire power and electrical plant.

Worthington Electric Pump Outfit.

A NEAT and compact pumping outfit for house tank and similar service has recently been put out by Henry R. Worthington. The pump is of the type which is in use for a great variety of purposes, but is especially designed to supply the reservoir tanks of high office buildings and residences, where the pressure carried in the city mains, insufficient to elevate water above the lower stories, must be reinforced by pump pressure. The motor is connected to the pump entirely by belt, and, no cut gears intervening, the operation of the pump is noiseless.

The motor is of the C. A. type—a type designed and manufactured by the General Electric Co. to meet a demand for motors



WORTHINGTON AND G. E. PUMP OUTFIT.

adapted to the direct application of power to small machines. It is built in capacities of two h. p., one h. p., one-half h. p. and one-eighth h. p. The first three are wound for use on 115, 230 and 500 volt circuits, the one-eighth being wound for 115 volts only. They are light and compact and occupy very little floor space, while they may, by a single change in the position of the bearings, be run in any position. The magnetic circuit is of laminated, instead of cast iron; the armature of toothed laminations with coils made up and insulated before application. The motor is mounted upon the base of the pump, making the combination one of the most compact on the market. The motor is stopped and started by an automatic switch operated by a float on the water in the tank. These pump combinations are built for capacities of 200 and 500 gallons, as required.

CLARKSBURG, W. VA. Mr. A. M. T. Cunningham, a leading business man of Clarksburg, is in the market for a complete electric light plant for that city, of both arc and incandescent lights. About four or five hundred arcs will be needed, and he will be glad to hear from manufacturers of apparatus.

PROVIDENCE, R. I. The Brown and Sharpe Manufacturing Co. recently installed a Rice & Sargent cross-compound condensing engine of 350 indicated horse-power in their main machine shop. The new engine takes the place of a pair of non-condensing simple engines of the Corliss type. One of these engines was built in 1872. The change will effect a saving of 10 tons of coal a week.

CATALOGUES.

Huebel & Manger.

This well known firm of 286-290 Graham street, Brooklyn, N. Y., have just issued their 1899 No. 4 catalogue, giving full descriptions and prices of belts, push buttons and other electrical goods made by them. A great variety of household electrical appliances are illustrated, such as those mentioned above, switches, letter boxes, binding posts, etc. The firm will be glad to send this catalogue to any one on application.

Electric Appliance Co , Chicago.

Catalogue No. 14, dealing with telephone apparatus, issued by the above company, of 242 Madison street, Chicago, Ill., has just been received, and contains a complete list of telephone appliances and construction material, manufactured and sold by this company. The list of apparatus shown is very complete and embraces every branch of the telephone art. The catalogue is well illustrated and should be in the hands of every one in need of telephone supplies. It contains 100 pages, has a handsome cover, a very complete index, and will be sent to any one on application.

Western Electric Co.'s "Petite" Arc Lamp.

Several weeks ago we described a new enclosed long burning arc lamp, developed by the Western Electric Co. of Chicago and New York, called the "Petite." The admirable features were pointed out at that time, and the company report that since then they have received a large number of orders for this type of lamp. They have recently issued a catalogue, which describes in detail various forms of this new lamp for indoor and outdoor service, as well as its mode of operation and accessory appliances. The catalogue is handsomely illustrated and bound, and is a valuable addition to arc light literature.

Western Electrical Supply Co., St. Louis.

This company, manufacturers and dealers in electrical apparatus, lighting, railway, house goods and telephone supplies, of St. Louis, Mo., have just issued catalogue No. 16, which deals exclusively with all kinds of electric railway apparatus. Among their well known specialties should be mentioned tops, arms and brackets for tubular poles, insulating trolley-wire hangers, trolley ears, connectors, rail bonds, gears and pinions, commutator bars, lights and gongs, cables, trolley and magnet wire, etc. They also illustrate a line of incandescent lamp sockets, lamps, fuse blocks, lineman's tools, etc. The book contains 120 pages, is well indexed, and will be sent to any one on application.

Welsbach Burners.

Active missionary work in the field of domestic illumination is almost as necessary to-day as when the incandescent electric lamp was first introduced, and relaxation of educational effort is indubitably followed by a slowing down in the advance of the electric lamp. The incandescent gas mantle became undoubtedly popular immediately after its introduction, and not until the public had purchased its experience was it willing again to listen to exact information regarding the real significance of the mantle. The General Electric Co., as the parent of electrical illumination, has done much to give accurate information to the public, expending considerable sums of money in test and experiment and publishing the results at its own expense. We have just received from that company a small pamphlet on the "Depreciation of Candle Power of Welsbach Mantles," giving the result of interesting tests made both in mantles and electric incandescent lamps. It contains information of use to every electric light station manager, as well as to the general public, and will be sent by the General Electric Co. to any one interested, on application.

NORMAN W. HENLEY & CO., 132 Nassau street, New York, publishers and dealers in scientific and technical books, report sales on the increase and a very good demand for electrical books, of which they carry a large line.

Digitized by Google

ADVERTISERS' HINTS

CHICAGO GENERAL FIXTURE CO., 169 Adams street, Chicago, are the Western selling agents of the W. C. Vosburg Mfg. Co. They carry a complete line of gas and electric fixtures and also electrical supplies.

CHICAGO ARMATURE CO. advertise second-hand apparatus. They are buyers and sellers of lamps and electrical machinery, and they rewind armatures, fields and transformers, and do a general business in electrical repairs.

J. JONES & SONS, 62 Cortlandt street, New York, say that in order to be up to date the buyer of switches must buy theirs, and they give their reasons for this statement.

THE STONE CITY TELEPHONE MFG. & CONSTRUCTION CO., Joliet, Ill., offer telephones at $5. Their prices range from $2.65 to $15. They will furnish further information on application.

QUEEN & CO., INCORPORATED, 1010 Chestnut street, Philadelphia, Pa., advertise ammeters, voltmeters and photometers, cable testing apparatus, etc.

PHŒNIX AUTOMATIC FILTER CO., Racine, Wis., are selling the Tracy oil filter, and claim this to be standard, reliable and perfect, and operates to save oil consumers 75 per cent.

THE MAYER DROP, single and double pole action, as well as spring jacks, plugs and telephone supplies, manufactured by Geo. M. Mayer, 79 Fifth avenue, Chicago, Ill., are receiving much favorable comment from numerous users and large orders for them are reported by M. Mayer.

WESTERN NOTES

COLUMBIA LAMPS. The Columbia Incandescent Lamp Co., St. Louis, have completed the changes and improvements that their factory has been undergoing for the past sixty days. Mr. A. C. Garrison, the secretary, reports that while considerably behind on orders owing to the heavy demands from all parts of the country, they are rapidly catching up. "We have," he says, "just completed arrangements for increasing our output about 25 per cent., and expect to be able to take care of the business more promptly and in the best possible shape, from this time on."

THE CRAIN PARHELION ARC LAMP is meeting with marked success, as evidenced by the large number of orders received, and the successful working of the lamp in the hands of the many buyers. That a lamp of any kind is guaranteed for a year is strong evidence that the manufacturers must be turning out a lamp that is most perfectly designed and manufactured. Another strong feature of the Crain Parhelion lamp is the possibility of changing the entire mechanism without disconnecting it from its terminals. Mr. Geo. H. Stout is general sales agent in Chicago.

GENERAL MANAGER JANSSEN, of the Vitro-Chrome Chemical Co., Milwaukee, says they have had an unprecedented demand for their "never wear off" coloring compound for incandescent lamps. The result of their advertisement in The Electrical Engineer has brought them business from not only the United States, but Belgium, Capetown, Chile and Japan.

MR. FRANK L. STAGG, Assistant General Manager Northern Electrical Manufacturing Co., Madison, Wis., reports that never in the history of the company have they been so busy as at the present time. They are working day and night shifts to catch up with their orders.

MR. ROBERT T. LOZIER, of the Bullock Electric Co., New York, paid the Chicago office of The Electrical Engineer a flying visit last week. Mr. Lozier was en route for a few days at the Omaha Exposition.

PRESIDENT BIRCH, of the Electrical Supply Co., Madison, Wis., says they have had large fall trade in the celebrated Ritter soldering iron of which they are selling agents.

THE WESTINGHOUSE ELECTRIC & MFG. CO. is doing a fine business in the way of alternating current factory transmissions. Among the important contracts closed within the last few months by Mr. W. H. Whiteside, who looks after that branch of the work for the Chicago office, are a 500 h. p. two-phase plant for the American Glucose Sugar Refining Co., of Waukegan, Ill.; a 400 h. p. three-phase plant for the Cobbs & Mitchell wood-working factory at Cadillac, Mich.; a 600 h. p. two-phase plant for the Parlin & Ornedorff Co. plow factory at Canton, Ill., and a 200 h. p. direct current plant for Kingan & Co., packers, Indianapolis.

NEW YORK NOTES

BRUSH ARC LIGHTS. Mr. S. M. Hamill, general manager of the Brush Electric Co., writes us that the demand for Brush apparatus continues brisk. He has recently closed orders for 60 machines of 100 arcs capacity each for John I. Beggs for the local Edison companies in Cincinnati and Milwaukee; also for thirty-two 100 arc lighters for Mr. F. A. Gilbert for the new Brush station in Baltimore. Mr. C. R. Huntley has ordered for the General Electric Co. in Buffalo some fifteen 125-lighters, and the city of Chicago has just placed an order for seven 160-lighters. All of which shows that "there is life in the old dog yet."

CONTENTS.

EDITORIALS:
Manchester Standard Wiring Rules and Regulations 386
The Success of the Conduit Trolley 386
Submarine Cables in International Politics 387
An Elevated Example from Chicago 387
POWER TRANSMISSION:
Colorado Electric Power Co.'s Station at Canon City (illustr.) ..... Bert E. Wade. 377
MISCELLANEOUS:
Electrical Refrigeration.—III. (illustr.) (concluded). Thomas J. Fay. 378
The Action of Electricity on Plants ..... E. H. Cook, D.Sc., F. I. C. 380
Novel method of Determining the Frequency of Alternating Currents 381
ELECTRIC TRANSPORTATION:
The Jungfrau Railway Power Plant (illustr.) 381
Thompson-Walker Surface Contact Railway (illustr.) 382
Three-Phase Railway at Evian-les-Bains (illustr.) 383
LITERATURE:
Emmet's "Alternating Current Wiring and Distribution" 385
Treadwell's "The Storage Battery" 385
ELECTRIC LIGHTING:
The Plant of the Long Beach and San Pedro Electric Co. (illustr.). 388
The Use of Electric Balloon Signaling in Arctic and Antarctic Expeditions ..... Eric Bruce. 389
MUNICIPAL AFFAIRS:
Some Views and Data on Municipal Ownership—II ..... Henry Hopkins. 389
TELEPHONY AND TELEGRAPHY:
The Boston Exchange District of the N. E. Tel. and Tel. Co. (illustr.).—The People's Telephone Co.: Competition in Greater New York 390
Illegality of Slot Telephones in Chicago.—Independent Telephony in Cleveland.—$3,000,000 for the N. Y. and N. J. Telephone Co.—Telegraphy in the Klondike 391
NEWS AND NOTES:
Electricity on the Brooklyn "L" Road 387
The St. James Portable Electric Burglar Alarm (illustr.) 392
The Use of Electricity in the Spanish-American War (illustr.) ..... Thomas G. Grier. 392
MECHANICAL:
Jones & Laughlin Co., Ltd., and the Production of Steel—I 394
SOCIETY AND CLUB NOTES:
National Electrical Credit Association 395
LEGAL NOTES:
Climax Boiler Patents Sustained.—New Motive Powers on Street Railroads 395
REPORTS OF COMPANIES:
Narragansett Electric Lighting Co.—Annual Figures of Western Union 396
PERSONAL:
Prof. W. M. Stine.—Mr. C. E. White.—Mr. H. A. Sinclair.—Mr. Horatio A. Foster 396
MARRIED:
Sykes—Sanborn.—Wheeler—Sutton.—Cooley—Bogart 396
THE STOCK MARKET:
One Eye on the Elections 396
TRADE NOTES AND NOVELTIES:
The Victor Circuit Breakers (illustr.).—Western Electric Heater (illustr.) 397
The Vought Incandescent Lamp Hanger (illustr.).—American Stokers at the Arbuckle Sugar Refinery.—Zimdars & Hunt Panel Board (illustr.).—"Stone City" Telephones 398
Huebel & Manger.—Electric Appliance Co.'s Catalogue.—Western Electric Co.'s "Petite" Arc Lamp.—Western Electric Supply Co., St. Louis.—Welsbach Burners.—Jandus Enclosed Arcs in Boston.—Worthington Electric Pump Outfit (illustr.) 399
Advertisers' Hints.—Western Notes.—New York Notes.—Philadelphia Notes 400

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. OCTOBER 27, 1898. No. 547.

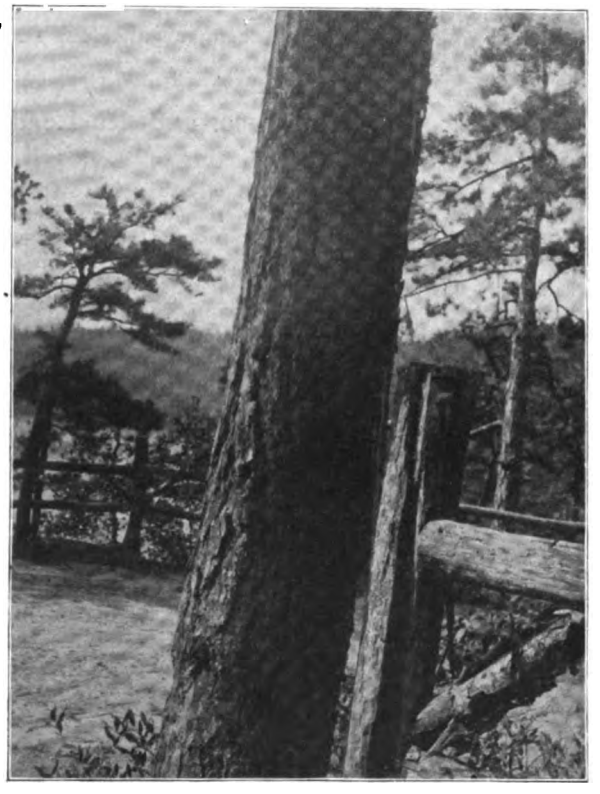
MISCELLANEOUS

The Current Strength of a Lightning Stroke.

BY ALEX. J. WURTS.

WHILE spending a few days in the Catskills last summer, I had an opportunity to observe some remarkable effects of two lightning strokes. The thunder storm occurred during the night, and on the following morning I found that lightning had struck a cone pine tree about 200 feet from the hotel. The stroke had entered several of the top branches, had then passed part way down the trunk as far as an insulator pin which supported the telephone wire of the hotel. So far the lightning had completely shattered the upper portion of the tree, hurling parts a hundred feet away.

The tie wire which held the telephone wire to the glass insulator was on the inside, that is, toward the tree from the insulator. The lightning jumped to this tie wire, burned it in two, and then, following the telephone wire, entered the hotel, and reaching the telephone booth, it there encountered the ordinary bell wire, the size of which was No. 18 B. & S. gauge. Apparently this was not able to carry the discharge without becoming heated sufficiently to ignite the insulation, which, being soaked with paraffine, caused a considerable blaze and set fire to the booth; fortunately this was extinguished before any considerable damage had been done. At the point where the fire had originated, about a foot of wire had been burned away and much of the insulation on the remainder of the wire was charred. The discharge finally passed to earth by leaping across a three-inch air space to an exposed gas pipe inside of the telephone booth.



VIEW SHOWING EFFECT OF LIGHTNING STROKE.

Having thus described the path of the stroke, the interesting features are as follows:

The soil is poor, about six to twelve inches deep, with solid, underlying rock. The hotel is 300 feet long, four stories high, and is liberally provided with lightning rods having 40 upper terminals. There are several lower terminals, some of which are grounded in the soil, others in a lake 200 feet distant. This lightning stroke, then, selected the pine tree in preference to a splendid system of lightning rods. There was no sign of burning on any portion of the tree. The melting of the tie wire of course means a high temperature at that point, and this fact would seem to indicate that lightning could not enter a wire without at least leaving a mark.

The fact that the telephone wire leading to the hotel, which was the ordinary galvanized iron wire used for such purposes, was not melted, is interesting in showing that the current strength of this particular stroke was not sufficient to melt this wire, which, it should be noted, was wet, uninsulated and exposed to cooling draughts of air. The charring of the insulation of the bell wire in the telephone booth, and the ignition of the paraffine, would indicate a current strength sufficient to raise a No. 18 copper wire to about a white heat, and, although it is impossible, of course, to determine the exact time taken by the current to pass through the wire, nevertheless the data is sufficient to suggest that the current strength of this particular stroke was at least hundreds, if not thousands, of amperes.

Not the least remarkable feature about this stroke was that, having shown preference for a tree in close proximity to so many lightning rods, it should leave the tree, about one-third the distance from the top, strike across two inches of air space, follow several hundred feet of horizontal wire, which is supposed to offer considerable inductive resistance to discharges of this nature, and then jump across three inches of air space to a gas pipe and thereby pass to earth, at a point which would have been reached by a much more direct path had the lightning stroke decided to follow any one of the hotel lightning rods.

On the same night there occurred another stroke about fifty feet from the other end of the hotel, which also struck a cone pine tree (see accompanying photograph), and, following its trunk to within about four feet of the earth's surface, it left the tree at a well-defined point, struck across six inches of air space to the top of a fence post, thence passed to earth. There was not a mark on the tree below the top of the post. The latter, it may be noted, had its core thoroughly decayed and was split open by the discharge. At the foot of the post there was a considerable hole; whether this was made by the lightning stroke or not it was impossible to say. However, about a mile distant from the hotel I found another tree which had evidently been struck during the same thunder storm; the discharge had passed spirally down the tree, at the base of which there was a large hole in the ground directly opposite the last trace which could be found of the path of the discharge down the trunk.

Is This a Curious Lightning Stroke?

A SHORT while ago we received from Mr. F. A. Pickernell, chief engineer of the American Telegraph and Telephone Company, a photograph of the lightning stroke reproduced in the accompanying engraving, page 402. This photograph was taken by Mr. G. D. Milne at Lexington, Mass., Sept. 2, 1898, at 8 p. m. The camera was of 8-inch focus and inclined upwards at an angle of 60 degrees. The interval between the lightning and the thunder was somewhat less than one second, indicating that the distance from the camera was from 800 to 1,000 feet. The photograph was submitted to several expert photographers, who unanimously pronounced the effect shown to be due to vibration of the camera.

Against this view the objection was raised that the duration of a lightning flash is so brief that no possible movement of a camera could have produced the effect. Again it was pointed out that some of the lines on the negative have a ribbonlike effect, while others have not. If this action were produced by vibration of the camera it would have affected the whole flash alike.

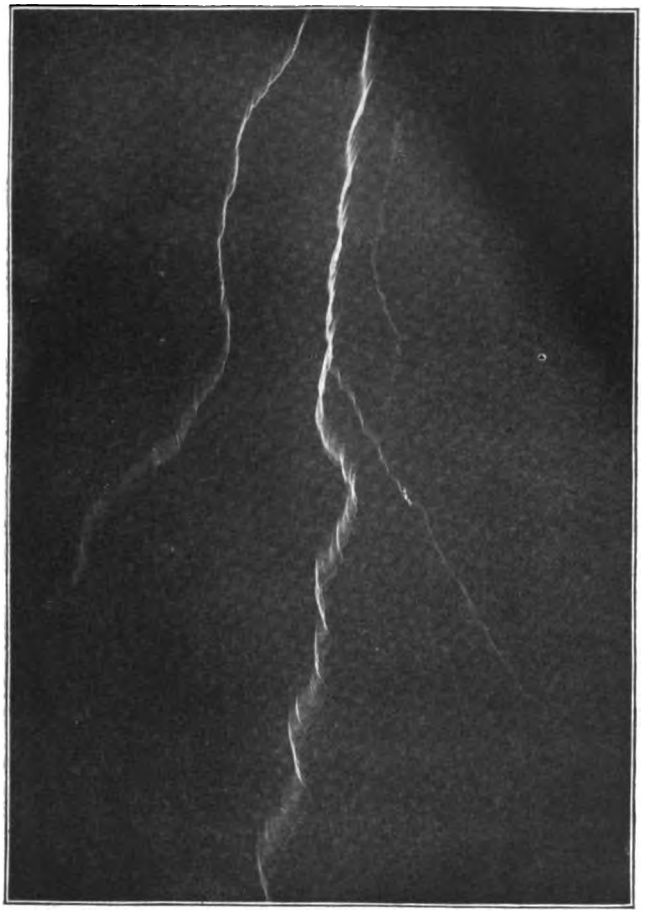
The photograph having been submitted to Prof. Elihu Thomson for his opinion, that gentleman has favored us with the following interesting comments:

"The photograph you sent me (with the letters of Mr. Pickernell) I have seen before, a copy having been sent me by a friend who knows Mr. Milne.

Digitized by Google

"If the camera was fixed at the time of the discharge, then the effect produced would be no accident, but a phenomenon, as I understand it. If it be admitted, however, that the camera shifted, as in wind, then the theory of accident would have to be considered. My view of the matter is this: that such an effect could be produced by a motion of the camera, and probably was so produced. To produce such an effect the motion of the camera would need to be in the direction almost of the line of the discharge. This would thicken or spread out in ribbon form any portion of the line of discharge which was in a transverse direction to the motion of the camera, and it would brighten and keep within line those portions of the discharge which happened to lie in the direction of the motion of the camera. The effect on the picture is precisely what has been stated, and the two chief discharges are affected in exactly the same way.

"When I saw the photograph at first, I supposed, of course, that it was submitted to me as the result of a photograph with a fixed camera. Perhaps such a result could be produced in



PHOTOGRAPH OF LIGHTNING STROKE.

spite of the fixedness of the camera, if a strong wind was blowing in the general direction of the discharge.

"It is a common mistake to assume that a lightning discharge occupies an exceedingly brief time. Because laboratory sparks have an exceedingly short duration, it by no means follows that all lightning discharges are so brief. In the first place, I have frequently seen lightning discharges which for a few seconds left a trail in the air shifted by the wind, and visible in daylight. I remember witnessing, with Prof. Houston, just such a storm in Philadelphia many years ago, each lightning discharge from cloud to earth showing a luminous trail for some little time, and after the discharge the trail was actually shifted and distorted by the wind. This is due to the same cause as a meteoric trail, viz., the production in the path of the discharge or meteor of a stream of exceedingly hot gas, which does not instantly cool. If there be dust in the air, the particles would be rendered highly luminous, and remain so for a short time after the discharge.

"But it is well known that lightning discharges repeat themselves sometimes, with great rapidity, down the same path, which is practically for the time being a good conductor, and it is more than likely that a discharge having occurred between two points of cloud—or between cloud and earth—this same hot stream of gas becomes a conductor for discharges from relatively remote portions of the cloud; in other words, a disturbance spreads so as to discharge a much greater body of cloud than was concerned in the first or incipient disturbance. This would produce almost a continuous current for a short time, down the same path, and the inductive effects of lightning are in many instances only to be explained by a comparatively slow rise and fall of current in the path of the discharge.

"I consider it an entire mistake to suppose that all lightning discharges are of the nature of very high frequency discharges. Some of them doubtless are of relatively high frequency, others less so; and it is probable that the conditions of discharge in nature are sufficiently varied to produce rates of oscillation, slow or fast or no oscillation at all. The investigation of the true nature and character of lightning discharges is a rather unsatisfactory field of research, inasmuch as no one knows when the storms are coming, so as to be ready to make any tests; furthermore, few people are able to drop all other things which may engage their attention and devote themselves purely to investigating when a thunderstorm does occur. Under such circumstances we can only pile up facts of our experience, and reason upon them in the best way we can. I have naturally paid a great deal of attention to noting the phenomena of lightning when the occasion presented itself, and the conclusions above mentioned are some of the many which I have arrived at by degrees from the facts of experience."

We would be glad to have any comments that our readers may care to make on the subject.

The Paris Exposition of 1900, and Its Leading Features.

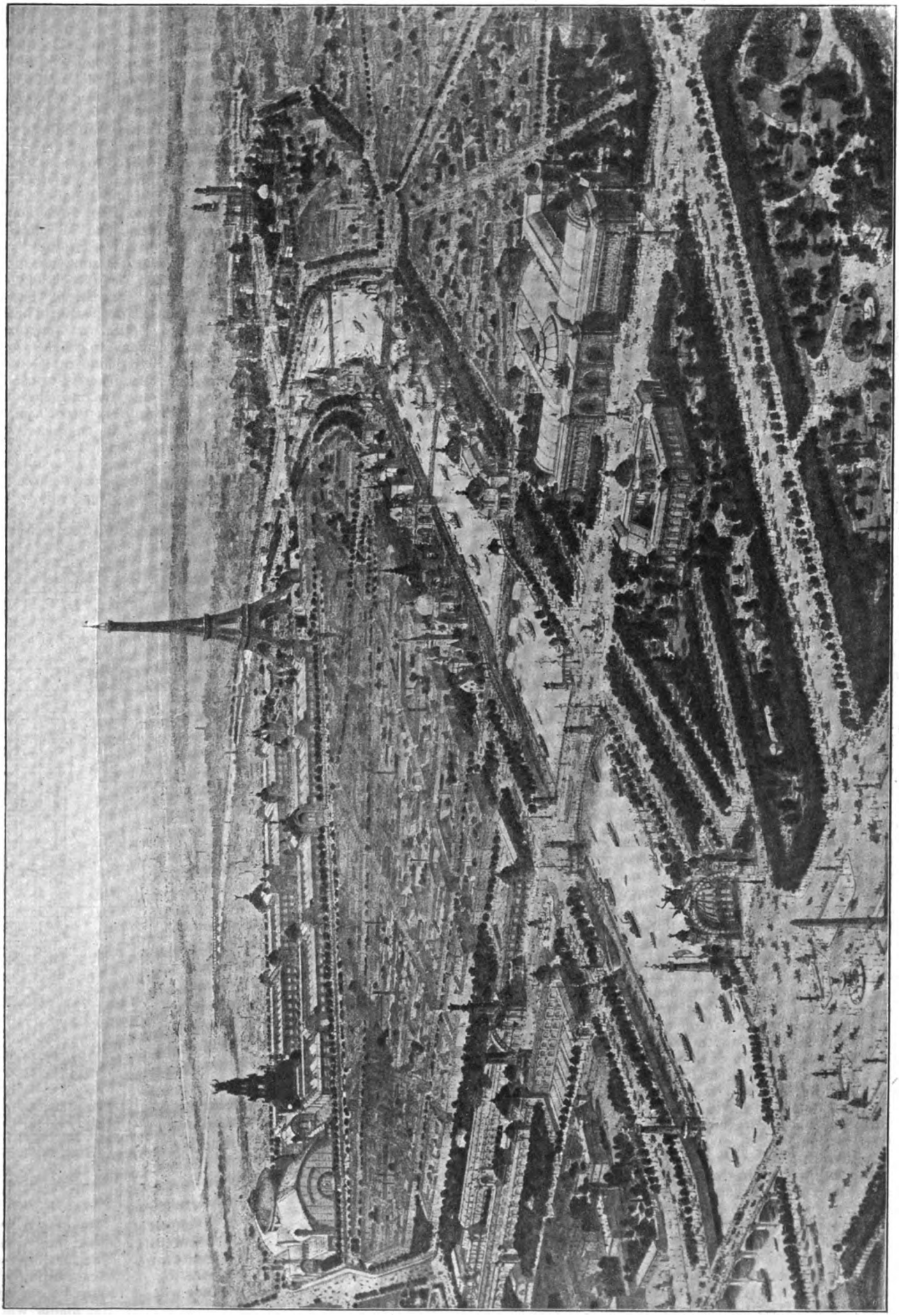
THE Paris Exposition of 1900 still seems remote to many people, but all who have had experience with such matters realize that the time is short for serious and successful work. In the present instance, not only is the time short, but the physical distance of the Exposition presents obstacles, and, most detrimental condition of all, the changes in the representation of this country have stood in the way of any systematic, consecutive work. The death of Special Commissioner Handy was followed by an interregnum, during which the Assistant Commissioner, Mr. Hamburger, tried hard to hold things together. Then came the visit to Paris on exhibition affairs, of Mr. T. W. Cridler, Assistant Secretary of State, and now Mr. F. W. Peck, of Chicago, is Commissioner General, and is in Paris organizing matters there, with a new staff that has entirely superseded the old one and which has begun work all over again. It would seem as though this country will need not a little luck and effort between now and April of 1900 to be in a position to do itself justice at that which is likely to be "the last of the great exhibitions" that have been so distinguishing a feature of the second half of the dying century.

Amid political changes and various alarms, the French authorities have steadily pressed forward in their preparations, although they have been singularly reticent in giving out any kind of details upon which an intending American exhibitor could base his plans. To-day, in this country, owing to this lack of a continuous exhibition staff, and of a prompt diffusion of data by the French staff, nothing is known definitely in regard to anything save the main features. It is hoped that on Commissioner Peck's return this grave drawback may be remedied: but meantime the progress of affairs up to date is worthy of review at this juncture.

Americans familiar with Paris or its topography, need only to be told that the Eiffel Tower and the Trocadero will form leading points in the Exposition of 1900, as they did of that of 1889. The space occupied is about 336 acres, or less than half the 750 acres of the Chicago Fair. Of the available space, at Paris, 45 per cent. has been reserved for domestic exhibitors, etc., leaving only 55 per cent. for all comers from outside. The space at first allotted to the United States was 108,676 square feet. This was raised by Major Handy to 147,403 feet, and the later efforts of Messrs. Cridler and Peck have been directed towards getting this increased, even as much as 25 per cent.

In the full page picture shown herewith, for which we are indebted to the "American Manufacturer," the main entrance to the Exposition will be seen located at the extreme northeast

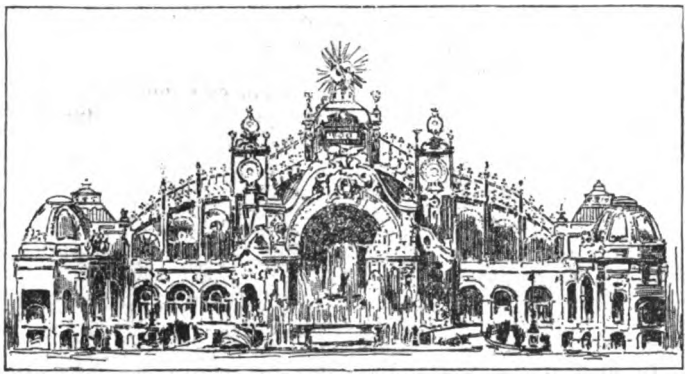
Digitized by Google



PARIS EXPOSITION OF 1900, FROM THE PLACE DE LA CONCORDE.

Digitized by Google

corner of the grounds, at the place where the Quai de la Conference adjoins the Place de la Concorde. The Quai extends along the north bank of the Seine for some distance to the northwest of this point. On the north side of this Quai lies the Champs Elysees, in a part of which was held the Exposition of 1855. The Palais de l'Industrie, which was the pricipal building of that Exposition has been demolished to make room for the two art palaces. These structures, which are known as the Great and



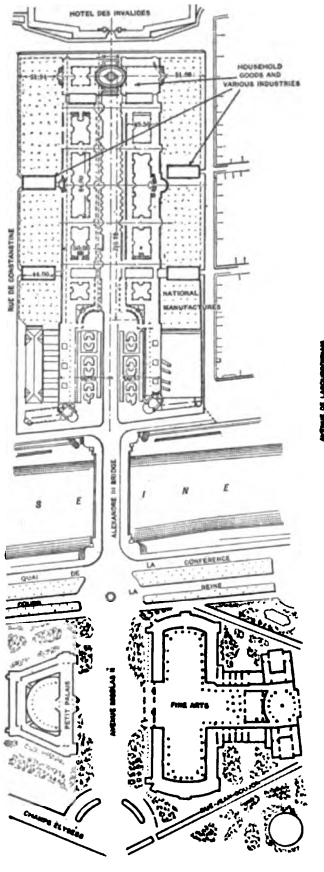
PROPOSED ELECTRICITY BUILDING AND FOUNTAIN.

Small Palaces of Fine Arts, respectively, are to be permanent, and the sum of $4,200,000 is to be spent in their construction. Across the Seine, and joined by the new Alexander III. Bridge, of which the Russian Czar laid the cornerstone in 1895, lies the Esplanade des Invalides. This tract of ground extends from the Seine to the Hotel des Invalides. In this plot will be located the great building of General Manufactures. This will not only be the largest building of the fair, but the design is the most elaborate architecturally. Here will also be the Education Building and various minor structures. Lying on either bank of the Seine to the west of these two plazas are long narrow strips of ground which form part of the plan. On the south bank is the Quai d'Orsay, in which will be the Army and Navy Buildings, and the pavilions of foreign nations. On the north bank are the Cours la Reine, the site of the buildings of the city of Paris, the building of Horticulture and Agriculture and that devoted to Social Economy, and the Quai Debilly, which extends from the Cours la Reine to the Trocadero Palace and Park, which was the site of the Exposition of 1878. In the Trocadero grounds will be located the colonial exhibits, both of France and foreign dependencies. The various locations are shown on the plans herewith.

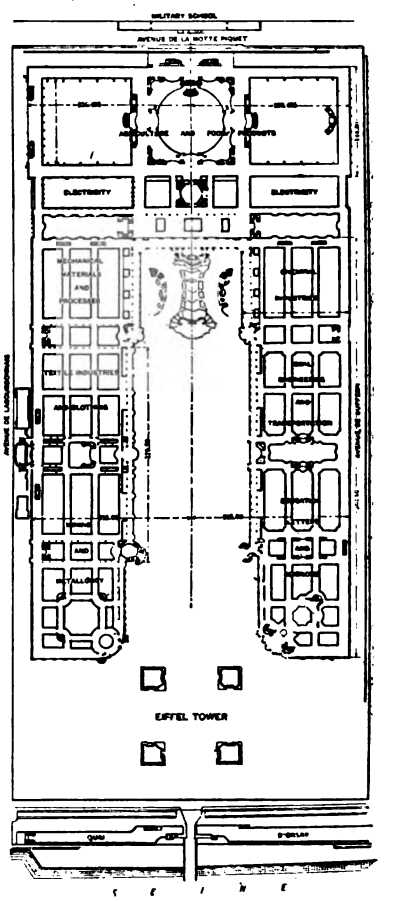
Across the Seine River from the Trocadero Park is the Champ de Mars, which was the site of the Exposition of 1889. At the extreme south of this plaza will be the structure devoted to Agriculture and Food Products. Next to it on the north is the site of the building for Electrical Industries, which, it is intended to make an even greater attraction than at previous expositions. From this point to the Seine River, this plot is divided into two parts by a central court which terminates at the Eiffel Tower. To the west of this court are grouped in order the buildings devoted to Chemical Industries, Transportation and Civil engineering, Liberal Arts and Instruments, General Processes of Science, Letters and Arts, and Forestry. These are all indicated by the plans. On the east side of the court will be the Machinery Building, Textile Building, the buildings of Mines and Mining, and of Navigation. The aim of the authorities is to have, as far as possible, all machines exhibited by the side of their products, and as a result of this plan the Machinery Building will be unusually small. Between the various tracts which form sites for the buildings, well-shaded avenues run in all directions so that progress from one portion of the grounds to another will be easy and pleasant.

As to the exhibits, it has already been noted above that a distinctive feature will be that of manufacturing in situ. To be more explicit, instead of permitting a mere pyramid of the object to represent the industry or art, the process of manufacture in each case will be shown in conjunction with the best typical specimens. If they are bottles or books, there will be a few bottles or a few books; but the machinery and processes will be close at hand also. This is why Machinery Hall will be much smaller than usual. The machinery will be scattered everywhere. To do this with steam power direct would have been impossible, but it is the intention of the management to allow only the use of electric motors for this purpose. Thus, on a grand and brilliant scale, the easy distribution and universal availability of electric power will be demonstrated. Hence there will be a huge central generating plant, and there will be literally thousands of motors scattered all over the Exposition in every department.

A view is given here of the large Electricity Building, which is said to have been designed specially and accepted, and in connection with which it is said that M. Picard, French Commissioner General, proposes to have a fine fountain, 34 meters high, discharging 1,200 liters a second, and at night illuminated electrically. A plant of something like 20,000 h. p., in direct coupled units, is spoken of, with Belleville boilers, and M. Picard is said also to favor a transmission of current from the Pas de Calais coal mines as suggested in these pages some years ago. So far as known, no American, English or French concerns have yet taken up any part of the power "concession," but several German firms have already submitted proposals: The Allgemeine Electricitaets Gesellschaft, of Berlin, an engine of 3,000 h. p., with two generators; the Siemens & Halske Co., of Berlin, an engine of 2,000 h. p., with one dynamo or an engine of 3,000 h. p., with two dynamos; the Schuckert Co., of Nuremburg, an engine of 1,500 h. p., with one dynamo; the O. L. Kummer Electric Co., of Dresden, an engine of 1,000 h. p., and one dynamo; the Helios Co., of Cologne, an engine of 2,000 h. p., and one dynamo; the W. Lahmeyer Electric Co., of Frankfort, an engine of 1,200 h. p., and one dynamo. It is said that the Exposition management has accepted the first three proposals. No belts or ropes are to be used. Steam will be supplied to the engines at about 142 pounds per square inch, subject to a variation of ten per cent. more or less. The dynamos, if



ESPLANADE DES INVALIDES.



CHAMP DE MARS.

direct current, must generate at either 125, 250 or 500 volts. Alternators, whether single-phase or three-phase, must supply at 2,200 volts, and have a periodicity of 50. The machines will be considered as exhibits, and will be judged accordingly for awards. The dynamos and engines will be required from April 15 to November 5. No workman running the plants will be

Digitized by Google

allowed to work more than seven hours per day. Payment will be made to the contractors in two ways. First, a sum to remunerate them for the first cost of installation of their plants, and, secondly, an hourly remuneration for the cost of running. This latter runs from about $2.75 per h. p. for steam dynamos up to 1,000 h. p., to $1.25 per h. p. for machines over 1,500 h. p. The whole of the steam and condensing water will be supplied free, and the supplier of the plant will also receive remuneration per h. p. hour at rates ranging from .3 cent for machines up to 1,000 h. p., to .102 cent for machines over 1,500 h. p.

Coming to the regular, and not special, exhibits, the following classes are of interest to our readers:

Class 23.—Machines and Appliances for Producing and Utilizing Electricity:

Dynamos for direct and alternating current.

Transmission of electrical energy. Electric motors: direct current, alternating current.

Transportation by electricity: electric locomotives, electric tramways. (See Class 32.)

Regulation of electric currents, transformers for alternating currents.

Appliances of electricity in mechanics: elevators, cranes, windlasses, capstans, swing bridges, trolleys, etc.

Measuring instruments.

Class 24.—Electro-Chemistry.

Electric batteries.

Accumulators.

General processes of electro-plating. Electro-metallic preparations.

Refining of metals and their alloys.

Application of electricity to industrial chemistry: bleaching, disinfection of drains, manufacture of soda, chlorine, chlorate of potash, etc.

Class 25.—Electric Lighting.

Class 26.—Electric Telegraphy and Telephones.

Class 27.—Various Applications of Electricity.

Scientific apparatus and instruments for precise measuring.

Electricity in surgery, dentistry and therapeutics.

Electric clocks.

Application of electricity to railways, mines and public works. Electric Signals. Electricity in the ignition of explosives.

Long distance indicators and registering appliances for phenomena of various descriptions.

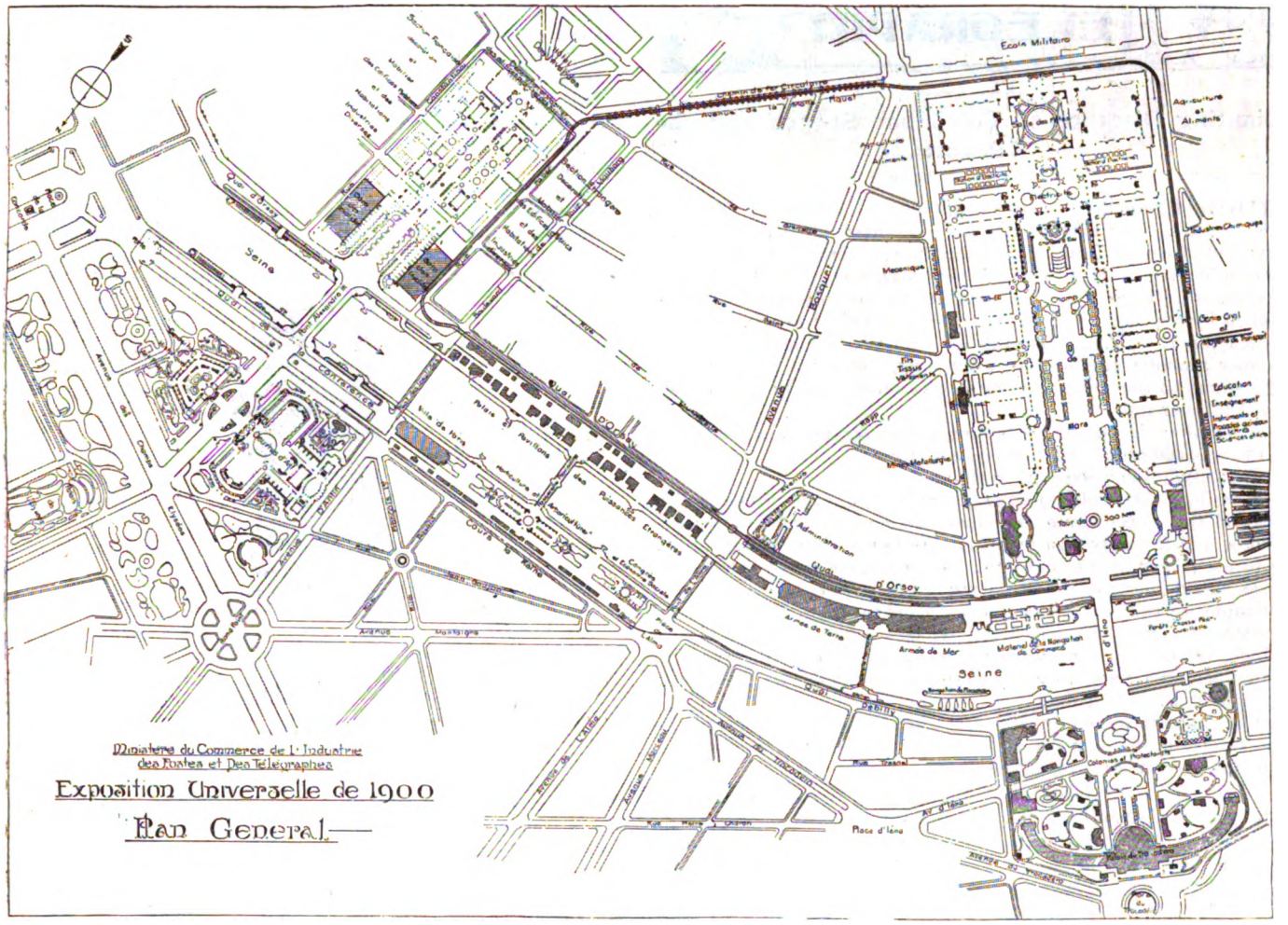
Electric heating furnaces.

Electricity for soldering iron, etc.

Apparatus and appliances for heating by electricity.

Class 32.—Railway and Tramway Material.

1. Passenger cars and carriages, freight cars, building and repair shops, snow plows, speed indicators and registers, dynamos, registering apparatus, models for laboratories.



GENERAL PLAN OF PARIS EXPOSITION OF 1900.

2. Other railway systems: grip, funicular, elevated, sliding railways, movable platforms, etc. Railroads: methods of operating, motive power, equipments.

3. Tramways: various types of tramways employed on different kinds of roads; systems of switching, appliances for putting down and cleaning lines, etc. Appliances for turning tramcars. Cars and omnibuses operated by horse power, horseless locomotives and carriages, rolling stock and equipment for tramways operated mechanically, brakes and similar appliances, apparatus for producing power that may be stored (hot water, compressed air, electricity, etc.).

4. Methods of transportation similar to railways. Transportation of boats on railways, etc.

Besides these must be noted Class 19, steam engines; Class 20, various vapor or gas motors; Class 21, general mechanical appliances and details; Class 22, machine tools; Class 28, machinery, apparatus and appliances in civil engineering; Classes 62, 63 and 64, metallurgy; Class 73, heating and ventilation; Classes 115 and 117, military and naval engineering. The electrical exhibits are classed generally in Group 5. As to space, it may be noted

Digitized by Google

that so far, only 48,420 square feet has been reserved for machinery, electricity and appliances, exclusive of the generating plant. At the outside, not more than 75,000 square feet seems likely to be available for these vast and important classes of American apparatus. No charge is made for space.

In addition to the electrical features above spoken of, there are others, such as the intramural electric road, about 2½ miles long, with 7 stations, with a capacity of 3,600 persons per station per hour, each way, with a train speed of 10 miles an hour. There is also the lighting, for which various plans are proposed; electric launches on the Seine, and other specialties.

TELEPHONY AND TELEGRAPHY

Limiting Distance of Telephone Speech and the KR Law.

BY A. E. DOBBS.

THE limiting distance of telephone speech has not yet been found. Our English cousins base their calculations on the law laid down by Lord Kelvin for the working of underground and submarine cables, which briefly stated is, that the limit of speech is reached when the capacity in microfarads, (K) multiplied by the resistance (R) equals a product of 50,000. This is called the K R law. Suppose, for example, we have a No. 14 copper metallic circuit, 400 miles long, having a resistance of 13.7 ohms to the mile, with an electrostatic capacity to earth of .0142 mf. per mile.

A metallic circuit 400 miles long means 800 miles of wire; 800 x 13.7=10,960 ohms, the resistance factor.

Capacity, .0142 x 800 = 11.36 mf.

K x R, 10,960 (ohms) x 11.36 (mf.)=124,175.6, which is far beyond the 50,000 limit, therefore too far for ordinary instruments, and the only way to bring this line within talking limits is to use larger wire to cut down the resistance factor. A larger wire would increase the K factor slightly, but for the present example we will leave that out, so in order to get the necessary resistance factor, we will have 50,000 ÷ 11.36 = 4.401 ohms, which, divided by the number of miles of wire (800), gives 5.5 ohms per mile, which, by consulting a wire table, we find equal to No. 10 B. & S. gauge.

The capacity induction increases slightly with the increase in the surface of the wire exposed, and the following table is nearly enough correct for all purposes.[1]

Lbs. per mile.	Resistance stand'd. ohms.	Capacity to earth.	Capacity wire to wire
100	8.781	0.0144	0.00864
150	5.854	0.0147	0.00882
200	4.39	0.015	0.009
300	2.929	0.0153	0.00918
400	2.195	0.0156	0.00936
600	1.464	0.0158	0.00948
800	1.098	0.016	0.0096

Which being translated to numbers of the Brown & Sharp gauge would read as follows:

No.	Wt. per mile.	Resistance.	Capacity to earth.	Limiting distance of speech, KR = 50,000; miles metallic circuit.
6	420	2.04	0.01562	625
7	333	2.6	0.01537	572
8	264	3.3	0.0151	300
9	209.5	4.3	0.01505	450
10	166	5.4	0.0148	400
			0.014425	320
14	66	13.7	0.0142	260
16	41	22.1	0.0141	200

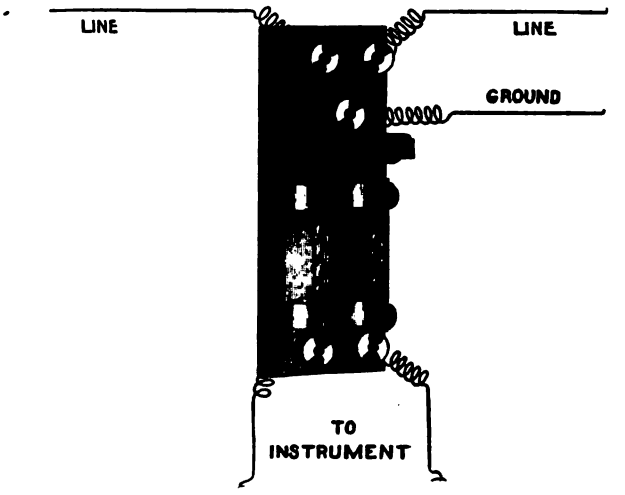
The capacity of any line is increased by the proximity of the earth, and for this reason the static charge is increased about eigh times the above amount in cable conductors.

Now in theory, and, as a laboratory test, the above law is perhaps all right, for men of the standing of Lord Kelvin and Mr. Preece would hardly announce it unless they were quite sure of results, but it will be noticed perhaps that the K factor is a very uncertain one, and both the above gentlemen have hedged considerably on the subject in recent years.

It might occur to our readers that if we can get rid of the capacity charge, that a large multiplying factor will be done away with, and that is where English and American practice differ. Thus in the line from London to Paris, a distance of 250 miles, they use a wire as large as No. 4 B. W. G., though they have of course to cross the channel, while in this country we talk from Boston to Omaha over a circuit none of which is larger than No. 6 B. & S., the K. R. of which from the table given above, would be over 400,000.

Lately, however, our English friends have discovered—what we knew long before—namely, that the lines could be cleared of the static charge, by increasing the self-induction and leakage. They place their wires seventeen inches apart, while ours do not exceed twelve, leaving a larger self-induction factor in our favor. Then our bridging bells, also, increase this factor, and also provide a path for the escape of the static induction between the wires themselves, which may be roughly taken at half the earth induction.

This balancing the static capacity with the mutual self-induction is a fine art, and building the New York and Chicago line required the best engineering talent of the American Telegraph and Telephone Company, to overcome some of the difficulties encountered. Thus in the mountainous parts of Pennsylvania the



TELEPHONE LIGHTNING ARRESTER.

static charges and earth currents were greatly increased owing to the mineral nature of the ground. This led to wide variations in the transposition distances, in some places being a mile and a half and in others only half a mile.

Another factor in reducing the static capacity, is that of having regular leaks to ground, with a resistance high enough to prevent any appreciable loss of current. This is accomplished by using a smaller insulator in telephonic, than in telegraphic or power transmission, and also in the device shown above, which is designed to protect the lines against lightning discharges. It will be seen that the lines would be shunted to ground through the carbon blocks, except for the thin strips of perforated mica intervening, which constitute an effective barrier against the escape of telephonic currents, but very little obstruction against the static discharges, and as every station is equipped with these, it will be seen that the static charge instead of being increased with the length of the line, becomes materially reduced, so that it amounts to simply that which gathers between stations.

Trees, the bête noire of all linemen, also assist sometimes in this work, if there are not too many of them, by affording a slight escape. Perhaps the reader has also noticed that during a rainstorm, while the volume of sound is much reduced, indicating a considerable escape of current, the articulation is much plainer, indicating a more perfect wave form. Perhaps, as a general rule, he has noticed that a telephone talks plainer by night than by day, owing to the action of fog and dew, and perhaps he has heard that telegraph operators have noticed the same thing in connection with their instruments. Capacity induction will

[1]See Electrical Engineer, Dec. 9, 1896.

Digitized by Google

not be reduced, but increased, by the use of insulated wire, as rubber or weatherproof compounds will store up the charge, and practically increase the surface of the wire to the diameter of the insulation.

It will also be well to remember that measurements for static capacity are made with open lines, and that the introduction of bridging bells and lightning arresters in circuit, will reduce it very materially, if not neutralize it altogether.

It may seem strange when we consider that static charges are caused by imperfect insulation, to advocate lowering the insulation, still farther, but we must remember that perfect insulation cannot be had (unless it were possible to suspend both wires and instruments five miles in the air by means of balloons), and that the best insulation only holds the charge on the line, till it increases in volume sufficiently to clear itself at the place where the insulation is weakest, which is generally near the instruments.

Those who have tried taking current from a static machine or a rapidly moving belt will recollect that the better the insulation under them the harder the shocks they received, but that by standing on a damp floor, or connected to ground, the charge is dispersed as rapidly as accumulated, the shocks being very light, though of course much depends on the character of the machine.

Lord Kelvin has even proposed to clear cables of their static induction, by introducing leaks at regular intervals, with a resistance high enough to prevent too great a loss of current, while Mr. Preece proposes to lower it by placing the conductors as close together as possible, thus increasing the self-induction. It is possible to go to extremes with both of these plans.

One thing in connection with the figure deserves attention. The object of the lightning arrester is to shunt the current to ground, and a few turns of wire "pigtailed," as shown in the upper part of the cut, may introduce resistance enough to keep the lightning back, till it accumulates to a dangerous amount. Bring the wires in as straight as posible. A few turns between the arrester and the instrument, however, are an advantage as tending to keep the lightning out and more surely shunting it to ground.

Now the only disturbing factor remaining, is the "skin effect," which is caused by the fact that rapidly alternating impulses are confined largely to the surface of the wire; the first impulse striking the surface, and sinking in, as it were, towards the centre, and rising to the surface again when the current is reversed, in time to meet, and oppose, the next wave. This factor with telephone currents, is a comparatively small one, however, otherwise the transmission of current 1,000 miles would be an impossibility. But the skin effect is based largely upon the quantity of current used, and telephone currents never exceed a few thousandths of an ampere and more frequently, the amount is in the 10,000ths. In comparatively short lines all these disturbances, together with lack of balance in the circuits, are apt to predominate up to about one hundred miles; but beyond this they will tend to neutralize and balance each other so that about the only factor to be considered is the resistance, and thus it sometimes happens that the longest toll lines give the most satisfactory service.

A long line carried on the same arm as a short one may cause considerable disturbance in the latter, unless the shorter one is frequently transposed, and for this reason toll lines should always be brought into the office by themselves, and not through the cable containing short and common return lines. The Bell practice is, to have a separate cable for all toll lines, of the best rubber insulation.

U. S. ELECTRIC LIGHT & POWER CO., New York City, has kept step with the Edison Co. in making a reduction in the price of current.

UNION TRACTION COMPANY, in Philadelphia, has unearthed and convicted a gang of swindlers who worked up street car "accidents" in order to fleece the company out of heavy damages. Two ex-employees were in the game.

IOLA, KAN. The Iola Rapid Transit Co. has succeeded in getting a franchise from the county for an electric trolley line, and from the city for both trolley and lighting. The company stands ready to offer special inducements to capital. All the smelters and factories in the vicinity use natural gas for fuel, the city being situated in the Allen county gas fields. W. S. Hendricks is president and A. W. Beck, secretary.

Some Views and Data On Municipal Ownership.—III.

BY HENRY HOPKINS,
Supt. Street Lighting, New Haven, Conn.

I AM reminded at this time of a certain newspaper that advocated municipal ownership. A short time after that, in the same town, an effort was made to buy a municipal printing plant. It was opposed by the above mentioned paper as not feasible on the ground that the work could not be done as cheaply as by those who already were in the advertising business.

That is where the shoe pinches. Take some one else's business, but do not molest ours. It would seem to me that what is fair in one case is fair in another. I will not tire you by quoting all the various figures given which conflict; will give you one example and then pass on:

1. $25.50 .....?
2. $46.09 .....?
3. $42.00 .....
4. $51.00 .....?
5. $47.00 .....?
6. $60.00 .....
7. $51.00 .....?
8. $80.83 ..... ?

The above lines show the difference in municipal reports. What is the correct solution? Here are the facts: A committee went from Springfield, Ill., to Crawfordsville, Ind. The price to produce lights was given them as per line 1. Report to Connorsville, Ind., by Crawfordsville as per line 2. Report from Little Rock, Ark., to Connorsville. Cost given as per line 3. Mobile, Ala., committee were told by officials at Little Rock, as per line 4. Scranton, Pa., were informed that the cost at Little Rock was as per line 5. Steubenville, O., was told as per line 6. One official at Little Rock made the cost as per line 7. The City Clerk at Little Rock says all the above is wrong and the correct figure is at line 8. One thing is noticeable, that the more the affair is investigated, the more costly and uncertain it appears. Is not a fair, set cost more satisfactory than an uncertain and upward scale, business principles considered?

Conflicting opinions occur in regard to nearly every municipal plant in the country in regard to actual cost of production. Why was it that nearly the entire press of Philadelphia urged the lease of the city gas plant to private parties? Because its citizens after nearly a half a century found their plant was in a deplorable condition, producing poor gas, giving miserable service, with mains wherein the leakage represented $150,000 a year, a venerable and antiquated plant; on a pay roll of two-thirds more men than they could profitably put to work. Rather than make an immense outlay of money to modernize the plant, the city signed the lease, and thus signified that they had enough of municipal ownership control, or rather, municipal non-control.

Their experience puts me in mind of a friend of mine who has ten children, and among so many youngsters the playthings were broken often and soon became dilapidated. While more money was expended for toys each year, the amount per capita was not as large as formerly; and when the eleventh infant came an indignation meeting was held, and this notice was posted on the front gate post:

Doctore
Please dont bring enny more
babies here we have had enuf.

The above represents fairly well the opinion of most places where municipal ownership has been tried.

The following item from a municipal ownership town has a slight grain of truth in it: "The war cloud has shifted and is now hovering over Xenia, O. The 'Herald' of that place, proclaims it thus: The time has come for action. The streets are in a horrible condition. The police fund is exhausted, and our militia has gone to the war. 'Ed.' Schmidt owns the council, and the city is in darkness. Burglars are at large, and the Meth-

Digitized by Google

odist Conference will be here in a few days. Johnny, get your gun!"

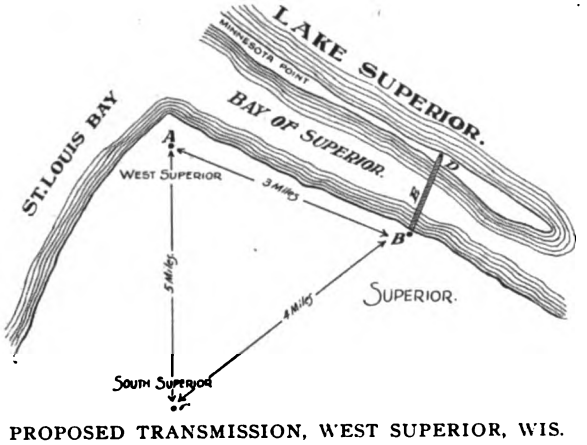
I have had some little experience in corresponding with professors who advocate the municipal side and I readily recall the name of one who signed his name prefixed with "Yours for the cause," and inserted a postscript that his terms would be $35 per day to address a convention. I am free to confess that at one time I had the fever, temperature 120 degs., but have lived to get over it, thanks to Dr. Investigation, and I fully realized that it is hard to wean men from their prejudices.

What is better than municipal ownership, and if it was carried out would soon kill the hue and cry for it, would be a stated term of years for a franchise; a more frequent valuation by the assessors of property; less property belonging to rich colleges to be exempt from taxation.

In regard to the first suggestion: This would enable the cities interested to hold the corporations to a fair bargain. As to the second, property that depreciates would be lowered in valuation, and the poorer taxpayer would then be satisfied that the property that is increasing in value would make up the difference as it should. As to the last, too much money is lost from estates owned by rich colleges, which control block after block in the heart of a city, thus creating an immense loss in taxes. This distribution of burdens would create a just plan to the satisfaction of the most of the people.

A Novel Power Transmission Scheme for West Superior, Wis.

THE Superior Water, Light and Power Company, of West Superior, Wis., has in contemplation certain changes in its water and electric plants that will be of interest to many of our readers, and Mr. W. H. Winslow, the secretary, has kindly furnished us with the data. In the first place, the water pressure in a portion of the city remote from and some 90 feet higher than the company's pumps is considered by the city authorities insufficient in case of fire; and it is proposed to install an electrically driven pump. This would in turn necessitate the use of some alternating or multiphase system, as the pump would be about five miles distant from the power station. As the company has several 133-cycle alternators, in use, some system which will work in with them will probably be adopted.



PROPOSED TRANSMISSION, WEST SUPERIOR, WIS.

Beyond this, according to Mr. Winslow, the company is likely to adopt a system of filtering their water supply, which will demand an electrically driven pump, capable of handling the entire water supply. The reason is as follows, and is elucidated by the accompanying little sketch:

The source of water supply is Minnesota Point, a long ridge of sand about 4,500 feet from the mainland. On this point the filter beds of the Superior Water, Light and Power Company will be situated if the plan is carried out. Mr. Winslow remarks: "It would, we consider, be very inconvenient to locate steam pumps on that point, and also very expensive to operate them there. We have been in correspondence with several manufacturers of cables, pumps, electrical apparatus, etc., but no decision has been reached by us, as we intend to take plenty of time to investigate." In the map, A is the power station, B the steam pumping station, C the point where the "boosting" pump is to be located, D the drive wells and the location of the proposed filter plant and pump. The intake pipe and the proposed submarine cables are indicated at E. The letter F indicates the water main connecting the pumping station with South Superior. All the distances are approximate. It will be interesting to see this ingenious plan put through.

Illumination in Boston and Providence Department Stores by Enclosed Arcs.

THE problem of illuminating large dry goods stores has been carefully and scientifically worked out in the large store of the O'Gorman Company, at Providence, R. I., and in the Houghton & Dutton store, in Boston. In the former store, which is one of the largest in Providence, 124 enclosed electric arc lamps are distributed throughout the different departments, and the new Houghton & Dutton Building uses 250 of the same lamps to illuminate portions of the building now completed.

In selecting the enclosed type of arc lamp, its various advantages over other types were carefully considered, and not until certain practical store tests had resulted favorably was the ultimate decision reached. In both cases the customers' appreciation is a gratifying testimony to the superiority of the enclosed arc lamp.

FIG. 1.—ENCLOSED ARCS IN A PROVIDENCE STORE.

The store of the O'Gorman Company, Fig. 1, is in the Alice Building, Providence, R. I., where it occupies seven floors and a basement, the fourth floor only being divided up into rooms. The first and second floors are each lighted by 20 lamps suspended so as to allow from 10 to 12 feet clear between the lamps and the floor. The third, fourth, fifth, sixth and seventh floors and basement are each lighted by 14 lamps hung at heights from the floor varying with the heights of the ceilings. The average area illuminated by each lamp is almost 600 square feet. The store of the O'Gorman Company is the most brilliantly and perfectly lighted in Providence.

Digitized by Google

The enclosed arc lamp being a comparatively new comer in the dry goods and department store field, some data will be interesting as to the departments of the O'Gorman Company. The first and second floors are devoted to the sale of general dry goods. The head of this department found the quality of the light excellent from the point of view of illumination, and of peculiar value as enabling both salesmen and customers to distinguish easily niceties of shade and texture in the goods. He commented on the absence of all shadows, the quantity of light being amply sufficient to eliminate them, although considerable space is occupied by pillars, cases, cash carriers, etc.

In the two departments on the third floor as much white light as possible is absolutely necessary. Indeed, in no other is a white light more essential than in these, devoted to the sale of the finer class of wall papers and to porcelains and chinawares. In the former the varied patterns and delicate shades of color demand a light which will not falsify them in any way; in the latter, without such a light the finer wares, such as Dresden, Wedgwood, Royal Worcester, etc., could hardly be sold on dark days or after sunset. The heads of these departments find the mild, clear, white light from the lamps in every way satisfactory and mentioned the fact that it was particularly easy on the eyes. Although these lamps are burned largely during the day, neither official had had trouble with his eyes since the lamps

FIG. 2.—BOSTON STORE LIT BY ENCLOSED ARCS.

were installed, while with all other forms of light the constant attention to delicacy of pattern and shades of color had seriously affected their eyesight. The fourth and fifth floors are given up to draperies and furniture. Here too the ease with which colors, under the enclosed arc, could be selected and such selection not be falsified on exposure to daylight, was considered the valuable feature of the lamp. Customers now rely upon this light fully, whereas in similar cases they could trust their judgment only by taking the goods to the window. The seventh floor contains the storeroom; the basement, books, shoes and dry goods and the abundance and even diffusion of the light burning during the entire business day, in this last department has added to the comfort both of the salesmen and customers.

The O'Gorman Company do not hesitate to express their full appreciation of the effectiveness of this method of lighting, selected only aftetr careful investigation and the satisfactory service it has given them. Furthermore, they heartily indorse and recommend the use of the enclosed arc lamp.

Fig. 2 shows the lighting of the china and glassware department of Houghton & Dutton, Boston, Mass. In this case double globe lamps are used instead of the single globe type, which, at the time these were installed had not been fully developed. The excellent results obtained are, however, similar(the intensity of light alone varying. To the General Electric Company Messrs. Houghton & Dutton recently wrote: "At the time we erected our new building at the corner of Tremont and Beacon streets, the matter of artificial illumination received a great amount of consideration. After thoroughly investigating all the various methods brought to our attention and looking into the apparatus and devices offered, we decided to make use of the enclosed, long-burning lamps made by your company. We have already about 250 installed. When our building is completed, there will be a considerable additional number. The light given is the most satisfactory substitute for sunlight in our millinery and fine dress goods departments that has ever been brought to our attention. The lamps are very cleanly and reliable in operation, do not scatter carbon dust, are ornamental in appearance and give an evenly diffused light.

Knight Templar Illuminations at Pittsburg.

THE people of Pittsburg are unanimously of the opinion that the electrical illuminations of the city during the conclave of the Knights Templars recently, comprised the largest and most artistic display of decorative electric lighting, that the world has ever seen. Be this as it may, and of course an allowance must be made for the fact that this remark was based considerably upon local pride, there is no record anywhere, which can show that there were ever celebrations held of any kind in this or any other country, where electrical decorations and illuminations played such an important part, and were displayed in such a complete and artistic manner.

The Allegheny County Light Company, which supplies the city and the general public with electric lighting current, operated during the conclave week about 3,500 horse power of electrical machinery in excess of the normal capacity of its central station plant. This current was distributed throughout the business portion of the city among numerous illuminated decorative pieces. There were 29 arches distributed across the prominent thoroughfares at the most central crossings using an aggregate capacity of 8,000 sixteen-candle-power incandescent lamps, or about 250 lights to each arch. These arches were built of gas pipe, and threw a radiance along the streets that gave one the impression that the atmosphere had been transformed into a sea of incandescence. Another piece of electrical illumination was a cross in the front of the tower of the county court house, where the local Tancred Commandery was located. This cross was 107 feet high, while the cross arm measured 67 feet; 2,000 16-c.-p. red and white lamps were placed upon this cross spelling the words "Headquarters Tancred Commandery, No. 48."

The next important display of electric lighting was made at the headquarters of Pittsburg Commandery No. 1, where 3,000 lamps had been used in signs on the front of the building and for decorative pieces in the interior. These headquarters were located at the Pittsburg High School building.

Other extensive displays were made by the Allegheny County Light Company on the Opera House building, where 5,000 lights were used; on the Dispatch building; the Hotel Henry; the Masonic Temple; the Hotel Duquesne; the Duquesne Theatre; the Alvin Theatre; the Second National Bank; the Eisner and Phillips building and several other structures.

There are, however, a number of isolated plants in the city of Pittsburg and very beautiful displays were made by them. The Times building had a Maltese cross of 1,000 purple, blue, red and white lamps; the Leader building had a "Cross and Crown" 75 feet high in the front of the building, composed of 800 red lamps. The First National Bank had its building festooned with garlands formed of vari-colored incandescent lamps. The Carnegie building was decorated with all manner of Masonic emblems and every one was made of colored incandescent lamps.

The most elaborate and expensive piece of electric decorative art was in the front of the general headquarters of the conclave in the Department of Public Safety building on Sixth avenue. This was an Ionic arch that cost $6,000. The electrical decorations on this arch were in the form of garlands, floral emblems and decorative lettering, numbering in all 1,700 lamps.

Mr. W. J. Hunker, the superintendent of the Allegheny County Light Company, estimates the number of electric lights used during the conclave for decorative purposes as 50,000 16-candle-power incandescent lamps. The effects of these decorations were simply superb and proved a revelation to the visitors. The large cross of the Tancred Commandery mentioned before has already been purchased by a commandery of Louisville, Ky., where the next Knights Templars conclave will take place.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Beta Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 9, 1888.*]

Vol. XXVI. NEW YORK, OCTOBER 27, 1898. No. 547

The Electric Motor Before the B. A.

A VERY interesting series of papers on the application of the electric motor were those read before the Mechanical Section of the British Association by Messrs. Siemens, Gibbings and Geipel. Each dealt with the description of a plant in which a number of motors have been installed, and the figures presented by the authors furnish good material for comparison. The papers, however, unlike those recently read before the N. E. L. A., evoked little discussion, except a few pointed remarks by Prof. S. P. Thompson against continuous and in favor of three-phase currents. In view of the fact that the latter have received but little attention on the other side and are employed in very few installations, Prof. Thompson's remarks were not received with the same favor, as would have been accorded to them in this country, where three phase currents are obtaining a strong foothold, and where motors and other apparatus employing and controlling such currents are nearing a state of perfection.

In speaking of the importance of increasing the load factor of a station in order to diminish the expense per unit of work done, Mr. Siemens made the significant statement that if power is wanted only at intervals and for short periods, it can safely be assumed that no economy can be effected by introducing transmission of power by electricity, adding, however, that "the most useful field for electric motors in workshops is without doubt their application to movable machinery such as cranes, travellers and drilling tools," all of which are intermittent loads. Another fact brought out by the figures of Mr. Siemens was that electricity can be generated and furnished at a much lower figure by a central station than by a private or factory plant, even if the latter is as well managed and the output as large as that of Messrs. Siemens Bros.' works at Charlton.

Mr. Gibbings pointed out the wide application of the electric motor in workshops and several novel uses for small motors. He advocated the scheme of hiring motors in order to encourage the user of small power, substantiating his views by the fact that in Bradford forty-two hired motors were connected to the mains in the first six months in 1898, against six owned by the consumers. This is directly contrary to American practice and experience.

Mr. Geipel repeated in glowing terms the advantages of the electric motor in the workshop, particularly in abolishing long lines of steam pipes and shafting. Apropos of this a few clinching facts in regard to the electric distribution in use at the Baldwin Locomotive Works, contained in a paper read by Mr. Geo. Gibbs recently before the New York Railroad Club, may be of interest in the way of confirmation. There are 215 motors in use ranging from 2 to 50 h. p. each, with an aggregate capacity of 1,930 h. p. The force of workmen needed for inspection and repairs of the lines and the 215 motors, as well as ten arc dynamos and four generators, consists of two men, with the occasional assistance of a third. One of these men works solely on armature repairs. The labor cost averages about $6 a day, and the material used in repairs is estimated at about $2 a day. The total maintenance and repair cost is, therefore, about $2,500 a year, or about 4 per cent. on the first cost of the plant. It is estimated that this is about the same as the maintenance cost of a mechanical system of power transmission. By the substitution of electric motors and the consequent removal of some shafting in the shops sufficient head room was obtained for compactly built electric cranes. This has reduced the labor involved in moving machines 50 per cent. or more, one incident being cited where four to six men do the work previously requiring forty, and do it more rapidly. Two 100-ton cranes in the erecting shop are each driven by a 50 h. p. motor, their installation effecting an immediate saving of eighty men.

Telephone Disturbances from Electrical Generators.

ONE hears but comparatively rarely nowadays of disturbances occasioned on telephone lines by extraneous currents on lighting and railway circuits, although at one time the courts were kept quite busy determining the rights of both interests in the case. The reason for this is, without doubt, that the courts have ruled in the majority of cases that it lay with the telephone company to so organize its apparatus that it might not be disturbed, and the telephone companies have taken the hint with as good a grace as they could under the circumstances, which in many cases involved considerable outlay in the rearrangement of circuits. Nevertheless, the last word on this subject has not been said, and a recent instance brings it up afresh, though in a somewhat different form. The particular occasion is referred to by Prof. Geo. D. Shepardson, in a recent résumé of the subject entitled "Some Telephone Disturbances from Electrical Generators," read before the A. I. E. E. As related by Prof. Shepardson, one of the street railway companies in a Western city installed a number of large railway generators which feed directly into a trolley line, and several large three-phase alternators driving rotaries located at three sub-stations. It so happened that at the same time one of the lighting companies installed rotaries driven by three-phase current from its main stations, and when the rotaries were put into service the telephones of the city were greatly disturbed, and some even rendered useless. Not only the telephone companies, but the lighting companies also found that the constant potential arc lamps which had heretofore been burning quietly began to hum and roar, as if operated by alternating currents.

The opportunity was seized upon by Prof. Shepardson and Mr. F. W. Springer to undertake the study of the causes of the disturbance. They made a preliminary search of literature on the subject of telephone circuit disturbances, and found such to be due to leakage and induction, both electrostatic and electrodynamic. As to the direct effect of electric railway lines, the ground return, of course, may be considered the primary and principal cause of trouble. Yet, on the other hand, if the railway currents were perfectly smooth and of uniform strength, it is generally agreed that they will not cause noises in the telephone, but will be less disturbing. The irregularities and fluctuations observed, however, in the railway current have been attributed to half a dozen different causes, including imperfect commutation at the dynamos, sparking at the motor brushes, or trolley, or rails, imperfect connection between trolley wire and supports, etc. All of those causes are more or less substantiated by various investigators. In the instance mentioned by Prof. Shepardson, the great increase in noises in the telephones was attributed to the fact that the new generators and rotaries had toothed armatures, whereas the old armatures had smooth cores and were surface wound. The greater self-induction in the two machines was supposed to cause irregularities or "wiggles" in the current. Some even believed that in some way part of the alternating current managed to get over into the direct current circuits without being transformed. Prof. Shepardson's first experiments showed that no considerable part of the noise came from any lack of uniformity in the speed of the rotaries, proved by the absence in the telephone of any tone of a pitch equal to the product of revolutions by the poles of the rotaries. It was also proved that the alternating current did not go over to the direct

Digitized by Google

current lines, by observations made upon the constant potential arc lamps operated by the rotaries of the lighting company. Here it was found that the hum of the arc lamps did not at all correspond with the frequency of the current, but that it did correspond exactly with the hum of the brushes, the pitch of which was equal to the product of revolutions by the commutator brushes. The cause of the noise in the telephones and arc lamps seemed, therefore, to be connected in some way with the commutation of the current at the direct current brushes.

It was to the brushes, therefore, that the investigators devoted their subsequent attention. In the first place they determined that the noise from the motor was found to be least for the position of least sparking, suggesting a means for finding such best position. They also found that by inserting an inductance coil in the circuit for "ironing out" the wrinkles in the fluctuating current the disturbance in the telephone could be greatly reduced, thus repeating what has already come into general practice among telephone companies that employ dynamo generators as a source of current for transmitters in place of transmitter batteries. The lighting company also found that the humming of its constant potential arc lamps was greatly reduced by the insertion of a choke coil in series. Experiments were also tried with iron core and with air core transformers for smoothing out the current. These experiments were made with the brushes in different positions, and they show that the smoothness of the current is affected by the width of the brushes, and by the various kinds of brush, such as carbon, copper, leaf, gauze, etc. Prof. Shepardson also deems it probable that the best pressure and best angle for the carbon brushes might be studied by the telephone or the electrodynamometer method. Other experiments on smooth core and toothed armatures showed that the pulsations were lower with the former.

Another interesting line of investigation in the same series is that involving the excitation of the dynamo by the battery current. The telephone receiver, without any connection, was placed near the pole-pieces of the dynamo, and immediately a roaring sound was heard which was in exact unison with that of the brushes. On raising the brushes, however, no sound was heard, but as soon as one brush was lowered upon the commutator the familiar roaring began again. The results proved that the currents in the coils short-circuited by the brushes affected the magnetism of the iron of the field magnet, although, as Prof. Shepardson points out, one would hardly expect that sluggish cast-iron and solid wrought iron would respond to 1,054 complex cycles per second. It thus seems tolerably certain that a good deal of the disturbance noted is traceable to the brushes and commutator, but that it is not due entirely, perhaps not at all, to the simple cutting of an armature coil out of the main circuit, being due rather to the more roundabout action of the current, the short-circuited coil causing pulsations in the strength of the whole field, and so affecting the total e. m. f. induced in the whole armature. Another reason for the greater pulsation in the particular case under discussion is believed to be the fact that the rotaries now used have both toothed armature and laminated pole-pieces, while machines formerly used had solid cast-iron pole-pieces and smooth body armatures.

The Pecuniary Value of Fine Scenery.

THE latest report of the commissioners for the State Reservation at Niagara brings up again in an acute form the old discussion over the value of scenery to the world. The report discusses the recent notable changes that have taken place at Niagara through the utilization of part of its energy, and falls foul of Lord Kelvin for his frankly avowed wish to see the whole of the energy of the great cataract turned to some useful purpose. His lordship on the occasion of his last visit suggested that the scientific man witnessed the present waste of power "with more or less conscious disturbance or disapproval." He is therefore set by the commissioners in the same pillory of reprehension as the stone blasters along the Hudson River palisades and the lumbermen in the Adirondack clearings. Viewing what has been done in developing the Niagara power electrically, the report says: "The question may well be asked: Has the interest in natural scenery of exceptional grandeur that prompted and approved the establishment of the State Reservation at Niagara and the Queen Victoria Niagara Falls Park wholly disappeared? or has the interest in the development of electrical power and manufacturing enterprises became so general and so dominant as to produce indifference to the future of Niagara Falls, and even tacit approval of scenes that cannot but be effective in diminishing the volume of the cataract, and defacing it as a world famous spectacle? At any rate, it must be admitted that the river and falls are at present not safeguarded from diversion anad destruction. And the only power that can provide absolutely sure protection is the combined power of the Government of the United States and that of Great Britain, known as Her Majesty's Government."

Thus the issue is clearly and sharply raised. It might not be a bad idea to have some limit set to the extent to which the upper Niagara River shall be drawn upon and diverted. But it seems to us that the commissioners meantime do protest too much. Unless we are very greatly misinformed, the privileges at present granted for tapping the river above the falls are about 500,000 h. p., and of that amount certainly not more than 50,000 to 60,000 h. p. is being converted. The power at the falls has been estimated on various bases, but never less than 6,750,000 h. p. Hence the legal limit at the present moment is less than one-twelfth of the capacity of the water flowing over the falls. The thickness of the sheet at the Horseshoe is over 16 feet, so that even when 500,000 h. p. is developed, it will only be 1¼ feet thinner, with a proportionate shallowing towards each bank of the river, and a like scaling down in the thickness of the sheet of the American Fall. Who would ever notice such a slight diminution as that? A drought along the lakes, an ice blockade, or a light wind blowing up into the neck of Lake Erie at Buffalo probably makes more difference several times a year. Hence we think that the commissioners put their complaint much too strongly. We might ask them another question, namely, whether it is not better on purely æsthetic grounds to generate that much power from running water rather than by burning an equivalent quantity of coal with all its grime and pollution?

But there is a point we would be glad to have the commissioners settle before they try to check the splendid and cleanly industrial development now going on around Niagara. It is said, and our own observation tends to prove it, that the falls are rapidly being broken into a series of slopes and rapids. The steep cliff is receding in a set of shelves under the weight of water bearing upon the strata now exposed. It seems to us a scientific proposition whether the diversion of a considerable portion of this mass of water—100,000,000 tons an hour—may not help to preserve the falls as they are, in their present majesty and beauty. At any rate, before they condemn great modern engineering work such as Kipling celebrates in some of his finest poetry, we venture to suggest to the commissioners that perhaps the engineer is not out of place at Niagara as they imagine, but is there by right and duty. And we say this with a full realizing sense of all that the Niagara Falls are to the hackmen, the New York Central Railroad and the hotel proprietors.

Uncle Sam Needs More Room.

FOR many years past the United States has done a great deal of internal expansion, but now, like the fat boy in Pickwick Papers, it is "swellin wisibly" and outwardly; and no power on earth seems able to stop the process that began not merely with the battle of Manila, but with the first cargo of American manufactures shipped to a foreign port. No matter what our "policy" may be, there is no question as to our desire for commercial aggrandizement, and our intention to win two customers where only one existed before. The next great opportunity to reach out in export trade and to show the world what we can do is the Paris Exposition of 1900; and in the hope and belief that international peace will prevail, our Government is now turning its energies in that direction. A large appropriation has been voted by Congress, and now Commissioner Peck has been endeavoring to get more room at the Exposition for our exhibits. So far, this country has been limited to a skimping 175,000 square feet, but Mr. Peck now reports that he has promise of 28,000 more, and that a space will be conceded for a national headquarters among the others on the banks of the Seine. We present in this issue a collocation of the data already made public on the Exposition, and trust that it may help to stimulate interest in this great and noble enterprise of our Gallic friends and neighbors. After securing the space, the great task will be that of filling it wisely; and as machinery and electricity have had less than 50,000 feet assigned to them, exclusive of the generating plant, it looks as though the selection of the exhibits will present many serious problems not yet confronted.

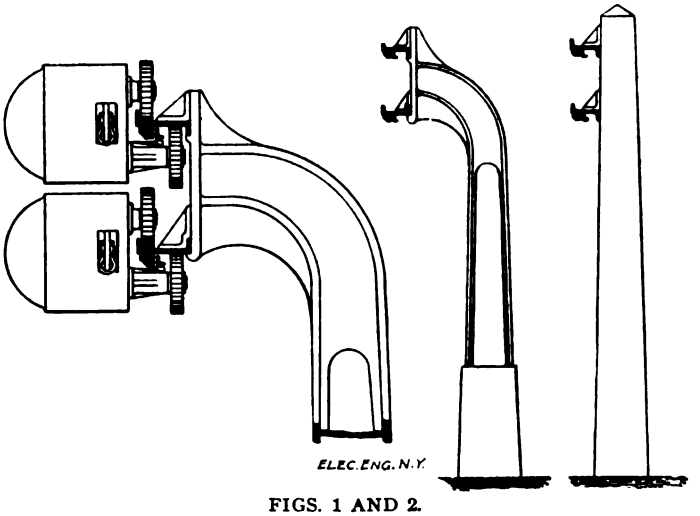
Digitized by Google

Electric Canal Haulage.[1]

BY A. H. ALLEN,
A. Inst. E. E.

THE method of haulage in general use remains the same as it was a century ago—by horses. Steam tug boats have, it is true, been adopted here and there, but their use is limited by many considerations, such as the cost of the boats, the damage done to the banks of the canal by the scouring action of the propellers, and the very low efficiency on account of the small cross section of the canal, while the cost of haulage is but little less than that of horse traction.

The subject of this paper is an adaptation of electrical traction to canal haulage, with a view to accelerating the speed and at the same time reducing the cost—the two most important considerations in connection with goods traffic. The system to be described is the outcome of years of study on the part of Messrs. Thwaite & Cawley, civil engineers, of Westminster; the aim of the inventors has been to provide an economical and efficient method of haulage, which can be applied to any canal, without in the least interfering with the use of horses—thus enabling the latter to be displaced by degrees, if desired. The system is about to be tested on one of the great Northern canals. It has been submitted to the critical examination of our most eminent canal



FIGS. 1 AND 2.

experts, and it is admitted that it shows promise of satisfying the numerous and difficult conditions of canal traction.

Previous attempts towards applying electric traction have generally been in the direction of supplying electrical energy, by means of overhead wires along the banks, to electromotors carried on board the barges; the motors were usually geared to screw propellers (as, for instance, on the Erie Canal), in one case to an ærial propeller. None of these methods has attained any degree of success—chiefly on account of the same difficulties as lie in the way of steam propulsion. A length of three miles on the Burgundy Canal is operated electrically by means of a chain laid along the bed of the canal; a tug boat fitted with an electromotor and chain barrel works to and fro on the chain, hauling a train of barges. The current is received from an overhead wire, and returns via the chain and earth. The system is well adapted for the case in question, as two out of the three miles are through tunnels; but the great loss of time incurred when one train passes another is a fatal bar to its general adoption.

In the present system all these difficulties are avoided by making the motors entirely independent of the barges, and hauling the latter by means of ropes, exactly as with horses; in this way the waste of energy incurred with a screw propeller is almost entirely obviated. An ærial railway is provided, consisting of two steel rails of channel or Z section, braced together at one side, so as to form a rigid girder, and supported at a height of 9 or 10 feet[2] above the towing path by means of cast-iron brackets or wooden posts (Fig. 1), at intervals of about 30 feet. Each of these rails constitutes a running track for a number of electric locomotives, each consisting simply of an electromotor

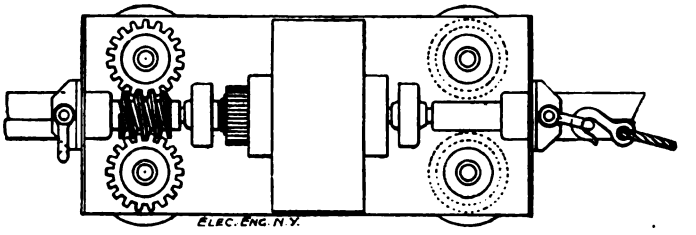


FIG. 3.

mounted on a four-wheeled carriage; two of the wheels run upon the upper surface of the rail, supporting the weight of the locomotive, and two run beneath the rail, bearing against the lower surface in such a way as to ensure the stability of the locomotive (Fig. 2). Two horizontal rollers are pressed by springs against the edge of the rail, in order to guide the carriage in the correct running position. The locomotive is thus locked to the rail, and is securely held in position by its own weight; moreover, by giving suitable proportions to the relative lengths of the axles of the wheels, the total pressure between the wheels and the rail can be made as great as may be desired—far greater than the weight of the locomotive itself—so that there is no limit to the adhesion which can be obtained between the wheels and rail. As the maximum drawbar pull of a railway locomotive under ordinary conditions is only about one-seventh of its weight, this is an important feature of the system.

The motor shaft carries at each end a worm, gearing with a

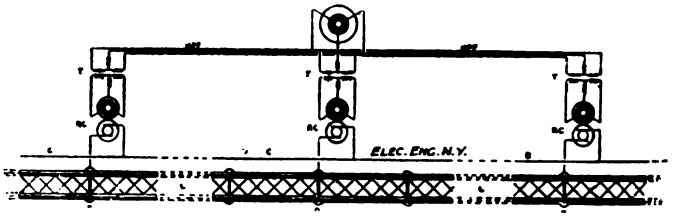


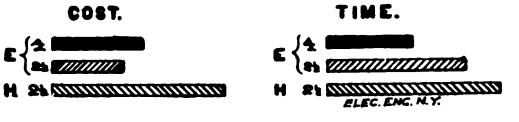
FIG. 4.

worm-wheel on each of the four axles, so that all the wheels are drivers (Fig. 3); the gearing runs in an oil bath, and can be so designed as to give an efficiency of 90 per cent. Automatic lubrication is provided for all the working parts, so that frequent inspection is not necessary.

The motor itself is of the ordinary direct current series-wound traction type, and need not be described in detail. The tractive force required to tow a barge carrying 100 tons on a canal of ordinary cross-section, at the rate of 2½ miles per hour, is from 250 to 300 pounds. The maximum brake horse power at full speed is, therefore:

$$= \frac{2.5 \times 5{,}280 \times 300}{60 \times 33{,}000} = 2 \text{ B.H.P}$$

But in order to get up speed quickly at starting, the motor must be designed to give a tractive force of about 600 pounds for a short time. Such a motor would weigh about 300 pounds,



CANAL WORKING BY HORSE AND BY ELECTRICITY.

and the weight of the motor and carriage would not exceed 900 pounds.

For a speed of four miles per hour, under the same conditions, the motor should give a tractive force of 750 pounds at full speed, and, say 1,200 pounds at starting. The weight of the

[1]Paper read before Sect. G. Brit. Assoc. Abstract.

[2]Where horses are not used, the rails may, with advantage, be fixed at a height not exceeding 6 feet from the ground, so that the locomotives may be more readily accessible.

Digitized by Google

motor would in this case be about 600 pounds, and of the motor and carriage about 1,400 pounds.

To the lower side of each rail is bolted a continuous creosoted wood batten, which supports the electrical conductor, a flat copper or steel angle bar, insulated from the wood by means of porcelain insulators. The position of the conductor is such that it is shielded from the weather, and to a great extent from mechanical injury.

The current is collected from the conductor by means of an insulated brush attached to the locomotive, and after passing through the motor is conducted by the wheels to the rails, which are electrically bonded together so as to provide a return path of low resistance.

It will be seen that the two rails form an "up" line and a "down" line, so that the locomotives run on the upper rail in one direction, and on the lower rail in the opposite direction. Each locomotive is provided with a link to which the tow-rope is attached. the other end of the tow-rope being secured to the mast of the barge exactly as in the case of horse haulage. When two barges meet, that one which is being towed by the lower locomotive steers close to the towing path, while the other barge steers wide, so that the tow-rope of the second barge passes clear over the first; thus there is no possibility of entanglement or crossing of the ropes, and the locomotives and barges pass freely without necessitating a stoppage. The importance of this point will be realized if it is borne in mind that on the average three minutes are lost every time two barges pass when drawn by horses, or about one-fifth of the whole time occupied in making a journey on a busy canal.

The locomotive is controlled entirely from the barge, no driver being required. Various methods of control are available; two light cords may be used, leading from the barge to a switch mounted on the motor carriage; or a single cord may be employed, together with a switch so constructed that on pulling the cord the switch is closed, the next pull opens the switch, and so on alternately. Another method of control is by the use of a concentric or twin-wire cable for the tow-rope; in this case the starting switch may be placed in the barge itself, in the charge of the barge-master, or the switch may be carried in the locomotive and controlled by electrical means from the barge. It should be remembered that, even when starting up to a speed of four miles an hour, the current at 500 volts would not exceed 14 or 15 amperes, so that elaborate switching apparatus is not necessary.

Since the whole apparatus is entirely separate from the barges, and complete in itself, it is evident that any barge or boat whatever may be towed without requiring the slightest alteration. On arrival at the end of the journey the locomotive may be at once coupled to another barge, leaving the first to be unloaded or otherwise at leisure; hence the plant can be kept continuously at work at its maximum earning capacity, and the ratio of the expenditure to the receipts can be kept down, both on this account, and because a given number of locomotives can serve the needs of a much greater number of barges.

Electrical power is supplied from one or more generating stations situated at suitable points on or near the canal; it is important to notice that water power may be used if such be available, or the generating plant may with great advantage be erected at a colliery if the canal passes through a coalfield, so as to obtain coal at the lowest possible rates. The canal itself supplies water for condensing purposes if steam power is used, but it is preferable to employ gas engines, by means of which, in conjunction with the Thwaite system of gas producers, it has been proved to be possible to generate one indicated horse-power-hour with an expenditure of less than one pound of coal.

In the case of long canals, the power would be transmitted on the three-phase alternating current system at high pressure, transforming down to direct current at low pressure at convenient points on the line, as shown in Fig. 4, in which B are the bonds; C, working conductor; G, three-phase alternating current generator; H P F, high-pressure feeders; L, ærial railway line; R C, rotary converters; T, stationary transformers. For short canals the current would be supplied direct to the line.

A very important feature of the system is the fact that not only will power be available for hauling barges, but it may also be used for working cranes, factory machinery, lock gates, etc., and for lighting warehouses and the canal itself if desired; a useful application of power is to capstans at the locks, by means of which the barges can be handled with rapidity and ease when entering the locks or leaving them. As canal traffic with electrical haulage can be carried on both by night and by day, the conditions of working are specially favorable to a low cost of power, the generating and distributing plant being constantly in use with no idle period.

In order to illustrate the economic possibilities of the system, estimates have been prepared showing the cost of haulage, (1) by horses; (2) by electric locomotives, at the same running speed as with horses; and (3) by electric locomotives at a higher speed (4 miles per hour). For the purpose of this comparison, the case of a level canal, 30 miles in length, has been taken, with an annual traffic of 100,000 tons per mile. The details of the estimates are given in an appendix to this paper. The results in brief are as follows:

	Cost per ton mile in pence.	Time occupied in transit in hours.
Haulage with horses at 2½ miles per hour...	0.077	15
Electric haulage, at 2½ miles per hour.....	0.032	12
Electric haulage, at 4 miles per hour.....	0.041	7½

It will be seen that without taking advantage of the higher speed possible with electric haulage, the cost is 58.4 per cent., and the time 20 per cent. less than with horses, while when the speed is increased to 4 miles per hour, the cost is 47 per cent., and the time 50 per cent. less than with horses.[1] Further, in the latter case, no allowance has been made for the reduction in the capital cost of barges (of which a smaller number would suffice), in the interest and depreciation on capital, and in the wages paid to bargemen, nor for the increase in the traffic and reduction of tolls which are sure to follow the increase in speed, the sale of electrical energy, the great reduction in cost of maintenance during prolonged frosts, etc., all of which are items of the first importance in this connection. To sum up, then, the electrical system of haulage possesses the following advantages, among others:

The boats require no alteration whatever.

The delays in passing incurred with horse haulage are obviated.

Bridges and tunnels cause neither difficulty nor delay.

No time is lost in waiting for a train of barges to be loaded, as is the case with steam.

Power can be supplied to private consumers, etc., at a low rate.

The cost of haulage is reduced by 50 or 60 per cent., and the time occupied in transit by 20 to 50 per cent., as compared with horse haulage. In case of frost, the standing expenses are enormously less than with horses.

Improved Shop Methods on the Calumet Road Chicago.

BY J. R. CRAVATH.

THE visitor to the shops of the Calumet Electric Street Railway of Chicago, of which road H. M. Sloan is general manager, and W. A. Harding, electrician and master mechanic, always finds something of interest in the way of improved methods of shop management and care of equipments or improvements in details on the rolling stock. One notable practice which came to the notice of the writer in a recent visit was the precautions taken for keeping armatures dry over winter on the motors that are out of use. The Calumet road is somewhat peculiarly situated as regards the ratio of summer and winter traffic. In the summer the immense trolley party and pleasure riding business for which this road is noted, requires an equipment several times as large as that needed to carry the ordinary business and workingmen's traffic in the winter. The result is that a large number of motor equipments under open cars are not needed under the closed winter cars, as there are many more open summer than closed winter cars, so that when the change takes place from open to closed cars in the fall, and the closed cars are equipped with the trucks and motors from under the open cars, there are a lot of open cars left to stand over winter with the motors under them. Now, it is well known that when machinery is allowed to stand in an unheated building over winter, it will, especialy early in the spring, condense moisture on its surface, and as there is but a poor chance to dry this moisture off in a cold car house, it will stand

[1] On some of our most important systems the dimensions of the canal and of the locks will only permit the passage of barges carrying 50 tons of cargo. In this case the saving in cost is increased to nearly 65 per cent. at 2½ miles per hour, and to 60 per cent. at 4 miles per hour, the same traffic being taken; but the cost of horse haulage is doubled, and that of electric haulage is also increased, though to a less extent.

Digitized by Google

for hours on the metal. This is the worst thing that could happen to a street car motor, and the difficulty is aggravated on the Calumet road by the fact that the ground on which the car house is built, as well as that for miles around, is of a low, swamp-like character. The cars are run into a storage barn for the winter, and as it is impracticable to heat this barn, the motors not in use must stand there and sweat until late in the spring. While the moisture does not seriously injure the plain painted iron surfaces, it does have a disastrous effect in working into armatures. When once rust starts at any spot on an iron armature core it gradually spreads. The rust penetrates the insulation, and after the motor has been run a short time the insulation breaks down. While iron rust itself cannot be classed as a conductor, it seems to hold enough moisture to ruin any insulating qualities it has of itself.

It has been Mr. Harding's experience that motors, after standing over winter in a cold car barn, will start out all right, but will soon come back into the shop with armatures to be repaired; and considerable money has been lost in this way. It will be the practice in future to take the armatures out of all cars not in use during the winter and store them in a dry room. An armature, winding and tool storeroom is being built for this purpose in one corner of the shop. Special precautions are being taken to have it dry underneath the floor, so that moisture will not come up from the ground, and the room will be kept somewhat warmer than the rest of the shop by air from the indirect steam heating system in use. Armature winders will also work in this room as they need a room warmer than the rest of the shop because they are not exercising their bodies as much as the other workmen. This room is also to be used as a tool storeroom, with a rigid system of checking out tools in use. Mr. Harding believes this the only satisfactory way of keeping track of tools and materials, so that they will be where they are wanted and not lost around the shop. Every tool will have a place on the toolroom shelf, and the toolroom will be in charge of a boy. In his care also beside the toolroom window will be a board on which will be hung several checks for each man in the shop. Each man will have a number. When a man wants a tool he goes to the toolroom window and asks for it. The boy gives him the tool and puts in place of the tool in the box a check bearing the man's number, and he also hangs a duplicate check bearing the same number on the "tools out" board. This latter is for convenience in seeing what men have tools out without going through all the tool boxes. A glance at the board at the end of the day shows just what men have tools out, and it can be followed up quicker than if there were no duplicate checks. Placing checks directly in the box from which an article came saves keeping any memorandum, and at the same time tells definitely what a man took out. Mr. Harding intends to do away with all benches against the walls because it is impossible to keep men from using them as rubbish receptacles. Along with this reform will come a sorting out of old bolts and nuts, with a box for each size. When a call is made for a bolt the tool boy will first see whether it is in the second-hand assortment before the storeroom is drawn on, and it is hoped to work off the old supplies in this way and put them to some good use instead of having them lumber up the corners. The checking out of tools may seem like unnecessary red tape at times, but it is the only way as long as human nature is what it is to keep men from laying down tools and losing them around the shop, with the result that more time is spent looking for tools than doing the work. This may easily be the case even in a small shop. Nothing can prevent the workman from losing his tools as some do while actually working with them; but he can be prevented by the checking system from losing them for very long.

The conventional form of hose for car wiring is being abandoned on this road in favor of a specially made cable. While in ordinary car wiring with series parallel controllers two lengths of hose are used between the two controllers, and each hose contains a number of wires which have been drawn into it, this new car wiring used on the Calumet employs a cable of such compact form, that the necessary number of conductors can be put in one cable. This cable contains the requisite number of braided and rubber-covered flexible stranded wires closely packed together, but independent of each other, the whole mass held together with waterproof tape and then covered with rubber and with a protecting sheath of braided jute covering. This cable has stood up very well under service, and the moisture from mud collecting on it does not seem to get through and rot the outer covering as it does the common hose.

The vestibule cars are being equipped with a very neat form of illuminated route sign, set into the lower part of the right hand front side of the vestibule, about a foot from the floor, just in front of the brake staff. The sign proper is flush with the vestibule, and can be slid in or out in guides. An incandescent lamp is set in a niche behind the sign. The body of the sign is opaque and is painted a different color for each route. The letters are cut in this body of the sign and the background is of white celluloid. This, of course, makes the letters show white by day. To make them show the route color at night was a problem that bothered à little at first, but it is now done by putting behind the white celluloid a layer of celluloid of the proper route color. This does not show by day when the color of the body of the sign is apparent, but by night the light shining through gives the proper color.

The Electric Arch at the Chicago Peace Jubilee.

THE handsomest and most substantial arch at the recent Peace Jubilee in Chicago was erected at the corner of La Salle and Washington streets, near the corner of the city hall. This arch was a gift to the city, presented jointly by the Western Electric Company, the Chicago Edison Company, and the General Electric Company. The design was furnished by John E. Youngberg and the work done by J. H. Goehst. The arch was 50 feet wide and 45 feet high, the bases being of substantial masonry with an outer covering of wood. The upper part was of frame covered by canvas. One thousand two hundred 16-candle-power lamps of 113 volts were fed by 3 No. 0000 cables, connected to the city hall lighting plant. It was wired on the 3-wire system and arranged in case of emergency so that it could be thrown on to the Chicago Edison Company's circuits.

ELECTRIC ARCH, CHICAGO PEACE JUBILEE, ARMY SIDE.

On the south side of the arch a large picture of President McKinley adorned the centre, with a row of portraits of the naval heroes, Dewey, Sampson, Schley, Evans, Clark, Wainwright, Hobson and Philip. Along the top two marine views—one, the battle of Manila, and the other the battle of Santiago, were on either side and below the portrait of the President. On the north side Gen. Miles' portrait adorned the centre flanked on either side by the military heroes, Shafter, Brooke, Marshall, Merritt, Cavanaugh, Turner, Lee and Moulton. Beneath the portraits was a picture showing the charge up the hill at San

Digitized by Google

Juan. All the work was done in oil and the electrical companies in ordering the work done, had the best skill obtainable.

Mayor Harrison contributed two poems in prose to be placed on the arch as the sentiments of the people of Chicago, as the

ELECTRIC ARCH, CHICAGO PEACE JUBILEE, NAVY SIDE.

arch was Chicago's tribute to its heroes. The first, which is placed on the east end of the arch, is as follows:

"Chicago salutes the heroes of the Army and swells the Hallelujah that hails their return from camp and trench and field."

"Heroes whose valor in action and fortitude in hardships have won tribute from every land."

"Hurrah for the American soldier, the young and the old, the blue and the gray, who shouted 'Ready' when the nation called."

On the west end of the arch was the greeting to the Navy; it reads:

"Chicago salutes the heroes of the navy and joins the chorus of jubilation over their triumphs for the flag. Triumphs which have set the world thinking and given the nations a new conception of American power, skill and daring."

"The memories that cluster around Manila Bay and Santiago Harbor will live as long as heroism is honored and heroes rewarded—forever."

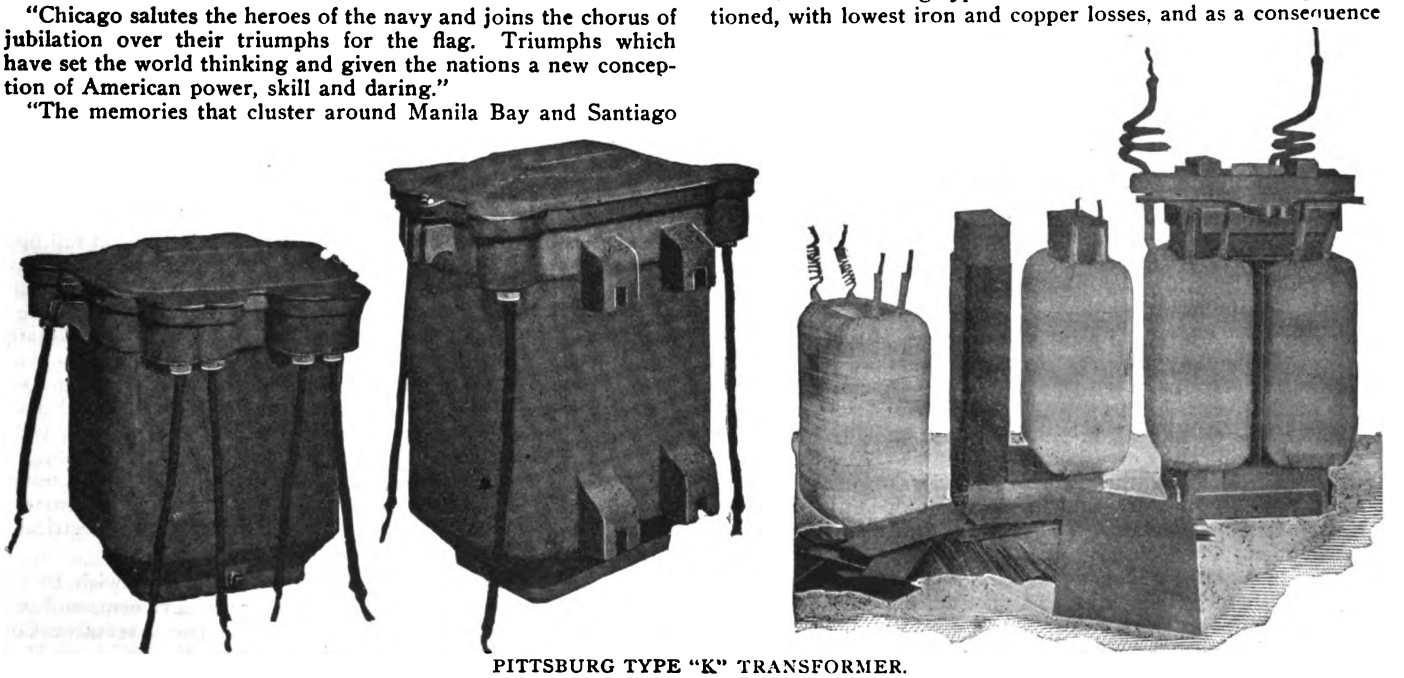
Around the top of the arch implements of war were in relief. Mr. T. G. Grier, of the Western Electric Company, as an electrical representative, was made one of the aides on the President's staff during the jubilee.

The "Pittsburg" Type K Transformer.

THE Pittsburg Transformer Company, Pittsburg, Pa., have lately developed and are now introducing a transformer, which is called their "type K," for use on 1,000 or 2,000-volt circuits of 50 to 150 cycles, with capacities from 600 to 20,000 watts. It is shown in detail and assembled in Figs. 1, 2 and 3 herewith. The iron core has the form of a rectangular letter "O," upon the long sides of which the windings are placed, there being two primary and two secondary coils, the primary being wound directly upon the secondary. For the laminations, the very finest grade of sheet steel is used, rolled from specially selected billets, picked out carefully from the best product of a leading manufacturer of electrical sheet steel. The transformers are wound with copper of the largest permissible cross section. In the larger sizes, thin copper strap in multiple arc is used, enabling 25 to 30 per cent. more of the available space to be utilized with reduced risk to the insulation and diminution of eddy currents to a negligible point. The coils are wound upon a mould. The secondary is wound first and wrapped with heavy mica insulation, and upon this is then wound the primary, constituting one solid member. Every layer is protected by a sheet of insulation extending well out beyond the ends of the windings; and all insulation is advantageously applied in flat sheets to smooth surfaces. The coil is fixed in position by means of hard fiber sheets inserted between the iron and the coil, and at each end of the coils fiber plates are placed as reinforcement. No wood is used to space, block or wedge the coils. The high tension winding is kept safely away from the core, and both cores are entirely outside the iron.

The transformer proper when complete is mounted in a cast iron case, as shown. The case is neatly japanned, and is such as to allow either of operation dry or with oil, the latter method being recommended as best in principle. The leads from the coils are brought out through porcelain bushings, well above the oil level, and turned perpendicularly downward as shown. The primary leads appear at the rear corners and the secondary leads are at the front of the case. Suspension of the transformer is effected by square-headed bolts or lag screws which engage with slotted lugs on the back of the case, as shown in the engraving of the 1,000-watt size.

All these Pittsburg type K transformers are liberally proportioned, with lowest iron and copper losses, and as a consequence of abundant metal and good design, the regulation is said to be the closest known. The rise in temperature is reported as exceedingly low. At the end of an eight-hour run under full rated load, the rise in temperature of the oil does not exceed 40 degs.



PITTSBURG TYPE "K" TRANSFORMER.

Fig. 1.—600 Watt Size. Fig. 2.—1,000 Watt Size. Fig. 3.—Details of Construction, 1,000 Watts.

Digitized by Google

Cent. They will carry overloads of 25 per cent. for periods up to 5 hours, with a temperature rise of only 45 degs. Cent., above the air. It follows that the all day efficiency, as the result of low core loss and slow temperature, is extremely high.

All transformers have to stand a 10,000-volt alternating e. m. f. insulation test, and careful measurements are made of iron loss, ratio of winding, etc., while runs of full load, 25 per cent. overload, and double rated potential are also made, to insure a perfect piece of enduring apparatus. The company also build transformers up to any degree of high tension work, and desire to submit estimates and plans for such work.

Methods of Determining the Frequency of Alternating Currents.[1]

BY CARL KINSLEY, WASHINGTON UNIVERSITY.

WE have all noticed the hum of a transformer or alternating current arc light. Upon the pitch of that note depends in a great measure the current of electricity there will exist in the wire. It is consequently of importance to electricians to determine the frequency of the alternations which produces the low note in electrical apparatus. If the electricity flows through an electro-magnet it will turn it into a pulsating magnet, which will make a piano wire stretched just tight enough vibrate as though it had been struck. From the force used to stretch the wire the rate of vibration of the wire and consequently of the alternating current can be calculated.

The same thing occurs when an iron strip is held in front of the magnet. Upon the length of the strip depends the rate of vibration, and that is easily calculated from the strip itself. Dr. John Hopkinson first used the piano wire and Dr. Campbell the iron strip.

Another way is to have a little of the electricity flow through a telephone receiver. The hum of the telephone will show just how fast the current is alternating. This rate of vibration can be measured by making the air in a long tube vibrate in unison with the telephone. It is merely necessary to measure the length of the tube in order to compute how fast the current is alternating. This method is capable of great rapidity of operation and accuracy in getting the result.

Still another method which can be most easily used of all of them consists in varying the rate of vibration of a metal strip, not by changing the length, but by hanging weights on the bar. Or else one weight may be used and its distance from the end of the bar varied. When the electrical current passes through the magnet the weight is moved until the bar vibrates. Then the position of the weight will tell the experimenter how many times a second the bar vibrates and consequently how many alternations per second the alternating current has.

[1]Read before the A. A. A. S. Abstract.

TWENTIETH TRIENNIAL EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, BOSTON, OCTOBER 10 TO DECEMBER 3, 1898.—I.

THE management of the exhibition deserve great credit for arranging a display of so interesting and instructive a nature as the present one, which, however, is only characteristic of the enterprising spirit and ingenuity of the Yankee. It is perhaps the first industrial exhibition which uses electricity as the exclusive motive power and though every branch of engineering, every line of development in the various arts and sciences and every novel process and application is ably represented, electricity stands foremost in the wonderful progress here shown. Wireless telegraphy receives here its first public demonstration in New England, the mysteries of the X-rays are shown. Moore's vacuum light is applied here for the first time as a living-room illuminant, electric welding under water is demonstrated, besides the application of electricity for domestic purposes, heating, lighting, cooking, power, etc.; electric carriages, a complete telephone switchboard in operation, electric generators and motors of every description and for innumerable purposes. The celebrated wax tableaux, showing the development of electrical science, which were described in The Engineer, in the issue of June 2, and many other electrical specialties and applications are shown in their latest forms. It is, in fact, to a large extent, an electrical exhibition. The decorations of the large central hall are most tastefully chosen and consist of red, white and blue bunting around the galleries and under the roof, from which are suspended numerous flags and coats-of-arms of various nations. A large oil painting of Washington is hung at one end of the building above the raised platform for the musicians. Special attention has been paid to the department of music and the patrons each day are treated to a splendid programme, including several solos by prominent artists and the rendering of classical numbers by well-known orchestras. At the other end of the hall occupying the stage and plainly shown in the general view, is the Japanese tea garden, which is a delightful innovation and an attractive feature. It affords an ideal resort for rest and refreshment, where visitors may be served by the daughters of Japan. A number of Japanese children are here seen in a beautiful Japanese garden with cherry trees in full bloom, playing their native games, chatting and entertaining. Much credit for this charming creation is due to Mr. Lafayette W. Seavey, the New York artist. Another attraction is the oriental smoking room furnished in the most complete oriental style, in charge of a native Turk. For one of the most popular features the management is indebted to Mr. B. F. Keith, who has fitted up Paul Revere hall, named after the first president of the association, as a vaudeville theatre, where entertainment is furnished throughout the day and evening, at no extra cost to the visitors. And right here it may be well to point out the wise step of the management in charging the small admission fee of 25 cents and nothing extra for the superb catalogue or any attraction. The soundness of this action is certainly attested by the average daily attendance of 10,000 people.

Mr. W. J. Clarke's wireless telegraph exhibition naturally creates a great deal of interest, questioning and surprise and Mr. Clarke is kept quite busy explaining the details and working of his apparatus all day, the letters N. Y.—N. Y.—N. Y., are transmitted across the spacious hall from the main floor to the gallery. Four times each day a miniature warship in the artificial lake of the Japanese garden, is blown up by the wireless transmitter in the gallery and the attention of every one in the hall is at those moments concentrated on that interesting, novel feature. The X-ray booth located on the second balcony in the grand hall contains Mr. Clarke's latest and most powerful apparatus and each hour large crowds of people pass through the booth, viewing their bones through an improved fluoroscope.

Special mention should also be made of a large number of operative exhibits all of which prove of great interest, and value to the visitors. There are shoe and hat manufactures in full operation; the manufacture and adjustment of fine watches, a number of printing presses, printing high-class magazines, textile machinery in operation, showing the process of manufacture of many fabrics, a complete candy kitchen, bottling establishment and refrigerating plant. In the basement, where the machinery is located, as well as the Moore parlor and the smoking room, many types of engines and generators are shown in actual operation, mechanical and electrical appliances are exhibited, as well as the Burton welding and forging process, the Diesel motor, running, horseless vehicles, etc. In fact, the exhibits are too numerous to mention in these columns, and we will confine ourselves to a description of those exhibits which are either electrical or have a direct bearing on electrical engineering.

In concluding these introductory remarks, we wish to congratulate the following men on their achievement and wish them success in their fine undertaking; The Executive Committee, consisting of Messrs. H. T. Rockwell, president; H. H. Watson, chairman; S. N. Davenport, treasurer, and H. D. Dupee, secretary and executive officer. Also Messrs. A. L. Knox, the superintendent; Samuel J. Byrne, the able and energetic press representative; R. D. Leonard, advertising agent; G. W. Wells, electrician; John Allen, chief engineer; B. F. Keith, proprietor of the theatre; S. A. Crowell, M. D., physician, and L. W. Seavey, the scenic artist.

Digitized by Google

Jones & Laughlin Co. Ltd., and the Production of Steel.—II.

THERE are two processes for making steel. One is known as the Bessemer process, the other, the "open hearth." These are not always distinct processes from the start, but the open hearth is a continuation or an additional treatment that a portion of the metal receives after having passed the Bessemer process. The initial step consists in remelting the pig iron in a blast furnace, not so large as the one before described, but which is charged at the top with pig iron, limestone and coke, as before described. When melted, however, the metal is not run into moulds, but is drawn into large ladles, which are mounted on trucks, and are taken to the Bessemer converters, into which the hot metal is poured. These converters, of which there are two, and which have a capacity of ten tons for a single charge, are large egg-shaped metal tanks, lined with fire brick, and mounted with trunnions, so that they can be turned to any angle, or revolve completely over. These have a large circular opening at the top, into which the metal is poured, while the inner lining of the bottom is filled with perforations, through which a hot blast of air is forced, causing the mass to ignite, and throwing off great sheets of flame and sparks, consuming the carbon and volatile matter contained in the metal, and so changing its character that its name is changed, and henceforth it is known as steel. This process illustrates the principle that everything, even iron, will burn when it is made hot enough, and is supplied with sufficient air to support combustion.

When the process has continued long enough, usually from nine to ten minutes, to burn out the undesirable element in the mass, and which step is indicated by the color of the flame and sparks, the blast is shut off and the metal, by tilting the furnace, is poured out into ladles mounted on trucks. These are run upon an elevated structure beneath the tracks of which, resting on other iron trucks, are hollow iron moulds or shells set on end, and open at both ends. These are known as ingot moulds, and hold from three to four tons each, the bore being from 18 to 20 inches square at the base, and tapering slightly to the top. Into these the metal is directed from the ladles, and when a sufficient number are filled, the miniature train is hauled away by a tiny locomotive to the stripping apparatus, by means of which the mould is stripped off from the ingot, leaving the ingot still red hot resting on the platform of the truck. There are two methods of stripping; one is known as the upright, and the other an inclined stripper. The former consists of a large hydraulic cylinder, mounted in a vertical position, having a plunger with two arms or hooks, one on each side of the plunger. For the operation, the train containing the moulds and ingots is run into position beneath this machine, when the plunger descends and rests upon the top of the ingot, holding it down while the two arms automatically close and hook under the lugs cast on the upper edge of the mould. Power is now exerted in two directions, and the mould is lifted or stripped off from the ingot and placed upon the empty car of another train that is standing just at hand. Both trains are moved up a car length at a time by means of arms actuated by hydraulic power.

Formerly it was the practice to place the moulds for casting ingots around the edge of circular pits, when they were filled from a ladle that was swung round by a large crane. By this process it was necessary, after filling the moulds, to lift the moulds and ingots out of the pit, a slow and expensive process. By the new process, as above described, they are moved about on the cars, and very little hoisting is required.

From the stripping machine the cars carrying the red hot ingots are hauled to the floor of what is known as the soaking pit. Here they are picked up one at a time by trolley hoists, which are provided with long handles, and by means of which the workmen can direct the operation without coming too near the hot metal. These trolley tongs run up and down the line of pits and deposit the ingots on end in the pits, which are located beneath an iron floor, and which have flat sliding iron covers, opened and closed by a hydraulic device. In the soaking pits the ingots are subjected to an intense heat from the burning of fuel gas that has been manufactured from coal on the premises. When sufficiently heated the ingots are lifted from the pits by the same trolleys and tongs by which they were put in, and are placed upright upon an iron truck that looks very like an ancient Roman chariot, and which is known in the mill as the executioner's chair. This is hauled by means of a wire rope to the table of the rolling mill, where it automatically dumps the ingot upon the feed rolls, when the engines are started, and the process of rolling ingots into billets begins. The large or initial rolls are actuated by a pair of quick reversing engines, having cylinders 50 x 72 inches, and which are capable of exerting, it is estimated, from 12,000 to 15,000 h. p. The lower set of rolls is a continuation of the main shaft. The ingot is passed rapidly back and forth between the rolls, being reduced in diameter and correspondingly lengthened by each pass. The rolls are adjusted by means of hydraulic mechanism, the operator being located on a platform from which he can watch the operation, while the engine is manipulated by a second operator who stands on the same platform. These engines, which are somewhat heavier than the celebrated English engines that are employed in the Johnson Company's rail mills at Lorain, Ohio, were manufactured in Pittsburg, and were designed by the company's engineer. As the process of rolling continues, the metal still hot is reduced to the proper cross section, and is run out to an enormous hydraulic shear capable of cutting a 200 square inch section. By this it is cut up into billets, which are usually from three to four feet in length. These, as fast as they are cut, are automatically loaded onto trucks having B-shaped racks on which the material, now known as billets, is delivered to the different mills for rolling into structural shape or delivered to the storage piles, where the billets bide their time for further rolling. A fifty ton electric traveling crane is part of the auxiliary equipment of this shop.

Open Hearth Furnaces.—Before we follow the process, however, we will turn aside to note the open hearth furnaces, of which there are six, each of 40 tons capacity. These are horizontal ovens of fire brick and are heated by fuel gas. The charge, which consists of a mixture of pig and scrap (by scrap we do not mean old metal but the ends that have been cut from bars and billets in the finishing processes), is first placed in cast-iron scoops or buckets about four feet in length, and having a capacity of from 300 to 400 pounds. These when filled are brought on trucks to the side doors of the furnaces, then by means of an electric charger the scoop is picked up, thrust through the opening, turned over, discharging the contents, and is then withdrawn and replaced upon the truck. This charger looks like an ancient battering ram, and consists of a long metal arm mounted on a car, which is moved by an electric motor, while a second motor actuates the arm. This arm locks itself into a socket provided at the end of the scoop and lifts it in a horizontal position, then extends, turns and retreats, and places the empty scoop back on the car, when the truck is moved to another furnace. This machine seems to have brains, and indeed it has, "the brains of the inventor." The metal from these furnaces, when sufficiently treated, is drawn into huge ladles, which are placed in a sunken pit at the opposite side of the furnace, and which when filled, are lifted, placed on trucks, and moved to the moulding floor, where the same process of casting the ingots, as before described, is repeated. There are a number of finishing mills adjacent to the main building, in which the billets, after being reheated in open hearth furnaces, are rolled into bars, rods, or structural shapes.

In one of the mills the different sets of rolls are arranged side by side, and the material as it passes back and forth, is elevated and shifted from one set of rolls to another, by means of an electrically operated table or car that runs on trucks in a subway in front of the rolls.

In another mill the rolls are placed in line, and so distanced and gauged in speed that the metal travels from one set directly to the other in a continuous bar, and after passing the last set and being of the desired section, is cut into suitable lengths by means of a "flying shear," when the rod runs on over a set of conical rollers, being held in place by an arrangement of vertical flanges, which, on being depressed, allows the rod, while still moving, to slide off sideways from the coned rollers. It is then immediately picked up and elevated by a gang of endless chains, which are provided with hooks and lift the bar to a second horizontal conveyor, which is supported on an elevated

Digitized by Google

structure, so that it clears the tracks and stores material and extends to the structural mill, situated some distance from the rolling mill. Or if it is designed for shipping, it is diverted sidewise at the end of this conveyor, and automatically loaded on cars, or placed on trucks, by which it is to be delivered to other mills or storage yards. The mechanical handling of hot metal is one of the principal features of this mill, and it is a constant study on the part of experts employed to simplify processes and provide for the economical distribution of the product. If all this were to be done by physical labor, it would require a great number of workmen, and it would be almost impossible to remove the material to a sufficient distance away from the mill to prevent a congestion and a necessary curtailing of output.

The material which is designed for structural work is chiefly in the form of I beams, angle bars, T's, and some special shapes. This on being rolled, is first straightened by being deftly manipulated under the plungers of heavy machines, when the sections are cut to proper lengths, either by sawing, or is sheared by specially designed cutters. I beams up to 24 inches in depth are cut by a peculiar shaped tool that makes a smooth cut without distorting the flanges. This tool is made with a flat blade, with tapering shoulders, and first cuts the web, the beam lying flat, when the slanting shoulders cut the flanges by side pressure. For ordinary cutting and when beams of various dimensions are alternately delivered, a circular saw is provided, or rather a plain disc, which is driven rapidly, which cuts the metal about as rapidly as a circular saw cuts timber.

KOSTEN DER KRAFTERZEUGUNG. (Cost of Power Generation.) By Charles Eberle. Wilhelm Knapp, 1898. Halle a S. 56 pages, 8x11½ inches. Price, $2.00. Paper.

This work is the result of the most painstaking calculations, and consists of tables on the cost of effective horse power hours of engines ranging in capacity from 4 to 1,000 h. p., and calculated for steam, gas, generator gas or petroleum engines. Where the price of the fuel and wages varies so much as it does between the United States and Germany (the tables before us are calculated for the latter country), it would be useless to draw comparisons on the general result or even to make a comparison between the results as they stand for Germany. The author himself, admitting, as he must, that the relation of the figures in all such calculations must vary in different cases and different locations, has tried to make his tables as generally applicable as possible by assuming various costs of coal in his calculations.

It may be interesting to the advocates of municipal ownership to point out the fact that in the case of steam engines the author places the depreciation of the engine and boiler plant of a simple engine type using saturated steam at 7 per cent., whereas, with the compound condensing engine, operating 365 days and all day, the depreciation is placed at 10 per cent. per annum. That on buildings is placed at 2½ per cent.

DIE ELEKTRISCHEN LICHTERSCHEINUNGEN ODER ENTLADUNGEN. (Electric Luminous Phenomena or Discharges). By Dr. O. Lehmann. Halle, a. S., Wm. Knapp, 1898; 6½ x 9½ in., 569 pages; 370 illustrations + 10 colored plates. Paper. Price, $8.

Now that vacuum tube lighting, to use a paradox, is "in the air," the desire for the fullest information on the subject is naturally very keen. Yet, when we come to examine the subject closely there still exists the densest ignorance regarding the phenomena of the electric discharge in gases, and this notwithstanding the fact that such phenomena have been among the most familiar in our daily life; in fact, all that relates to luminous electric phenomena and discharges designated as electric glow, brush discharge, spark and arc light in free air, or in vacuum tubes, is to a large extent empirical knowledge, pure and simple. Yet the literature on the subject, when gone into minutely, is by no means meagre, and any one who desires to take up study or work in this field must, if he desires to avoid waste of time, familiarize himself with what has been done. It is, therefore, with more than ordinary feelings of pleasure that we have perused the work before us. The author, with true German thoroughness, has left no record unturned, and has given us, we might say, a complete review of what has been done in this field. He takes up in their order, first the various kinds of discharges, in solid and fluid and gaseous bodies, electric convection, diffusion, disruptive discharge, and then passes to the luminous phenomena, in which he gives us a most minute account of the published work in this most fascinating field, and covers the subject in a manner which leaves nothing to be desired as regards thoroughness. The limits of space prevent us from going into detail, even in a small way, on the territory covered. Suffice it to say that the author has treated the subject under no less than sixty-four heads. Included in the record are the various discharges without luminous phenomena, such as Hertzian waves, cathode radiations and Röntgen rays. Besides giving the results of previous workers, Dr. Lehmann also includes those of his own.

The latter part of the work is devoted to the various molecular and etheric theories advanced in explanation of the phenomena on which the work treats, in which the author gives the theories of the various authorities who have devoted their attention to the subject. The value of the work is also greatly enhanced by the very copious references to original sources.

We cannot too strongly express gratitude for the facilities which the author has placed at our disposal in giving the history and current status of this most fascinating subject. It is facile princeps the magnum opus of its kind, and ought to be in the hands of every one who desires to be up to date on the subject. The work has been gotten up in a lavish style, the typography being exceptionally good, and the illustrations, many of them in colors, entirely original, and carried out in the most painstaking way. The index also is worthy of the work. An English translation, it seems to us, would prove a most timely undertaking.

Jerking of Trolley Cars at Starting Is Negligence.

N. Y. STATE. Appellate Div., 2d Dept. Samuel S. Whitehouse for appellant; Thomas L. Hughes for respondent. Dochtermann vs. Brooklyn Heights R. R. Co., 32 App. Div., 13. Decided at the June Term, 1898.

The plaintiff testified that she signalled a trolley car of the defendant, which stopped; that the motorman beckoned her to enter by the front platform, opening the gate for the purpose; that she got upon the platform, and just as she was stepping in, or had stepped into the car, and before she was able to sit down, it started with a violent jerk and she was thrown down and received the injuries on account of which this action was brought. The plaintiff and another passenger testified to the violence with which the car started. It was not disputed that the plaintiff was either thrown or fell down as testified. Expert testimony was given on the part of the plaintiff to show the proper manner of starting a trolley car, and that it could be started without a violent jerk. For the defendant the motorman and conductor testified that the car started properly, without any sudden or unusual jerk. Expert evidence was given that it was impossible to start the car without a marked jar. The jury found a verdict for the plaintiff. Thereafter the defendant's motion for a new trial was granted and the verdict set aside, and from the order granting a new trial plaintiff appealed.

Cullen, J., delivered the opinion of the court, saying in part as follows: "There is but one question presented on this appeal, whether the evidence of the defendant's negligence was sufficient to justify the submission of the cause to the jury, or whether its motion made at the trial to dismiss the complaint should have been granted. The burden of the argument of respondent's counsel is that a jar or jerk necessarily takes place when a car which is at rest is started in motion; and that, therefore, the occurrence of the jerk or jar is not evidence of negligence. This is true to a certain extent, but only to a certain extent. The question, like most questions, is one of degree.

Digitized by Google

Some jar must be experienced when a car assumes motion, but not necessarily a jar sufficient to cast down a standing person, or to throw a seated passenger almost off his seat." Citing Miles vs. King (18 App. Div., 41). "A fortiori would this rule be applicable to the case of a street car. But if we assume that a trolley car can be started only with a violence of motion that is not experienced in the starting of other cars or trains, it would not relieve the defendant from liability. The measure of the defendant's duty is the highest degree of human care and foresight. If there be this great danger in the operation of trolley cars, then the jury might well find that it was negligence to start a trolley car unless the passenger has obtained a seat, especially in the case of a woman. If the claim of the defendant in respect to the necessity of jars and jerks be true, it does not relieve it from liability, but simply shifts the exercise of its care from one direction to another. It cannot be tolerated that a carrier, subject to the measure of diligence stated, may successfully assert that in the ordinary and proper management of its road a passenger must necessarily and ordinarily risk the safety of his body and bones. While the defendant is not a guarantor of the safety of its passengers, still it must find some way of so conducting its business that its passengers shall be reasonably safe and secure. If a danger is created by the method of operating the road or the power employed, then the defendant must take means to obviate that danger." 97 N. Y., 259; 13 Misc. Rep., 387; 90 Hun., 419; 2 App. Div., 387, and other cases distinguished. Stierle vs. Union Railway Company (156 N. Y., 70) also distinguished.

Justice Cullen, speaking of the opinion in the last case, spoke of it as one "in which that court has corrected a prevailing misconception as to the measure of the duty of carriers of passengers in the operation of railroads—a misconception in which, I am frank to say, I shared." And, after stating the rule laid down in the case, said: "Whether this rule was intended by the court to apply to the operation of all railroads, either by horse power or by steam, and if distinction is to be drawn between horse cars and steam railroads, into which class the trolley car properly falls I do not know. But assuming that the liability in the operation of electric cars is no greater than that of horse cars, I am still of opinion that, considering the frequency of the occurrence of such accidents, the jury might properly find that it was want of even ordinary care to start the car until a woman had obtained her seat, whatever may be the rule when the passenger is a man." Order reversed, and judgment directed for plaintiff on the verdict.

Goodrich, P. J., and Woodward, J., dissented.

Enclosed Arc Lamp Decision.—The Marks and Ransom Patent Sustained.

In the suit of the Marks Enclosed Arc Light Company vs. Washington Mills Company, a decision has just been rendered in favor of the complainant. The suit was begun in the United States Circuit Court, Sept. 10, 1897, and the decision granted to the Marks Company by Judge Coxe on Oct. 18, 1898. The patent infringed is No. 520,996 of Marks & Ransom, dated June 5, 1894. This patent, it was claimed in the suit, broadly covers the method of operation used in all modern enclosed arc lamps. The Washington Mills Company were users of the Kinsman enclosed arc lamp sold by the Electric Construction and Supply Company, of New York. The decision peremptorily stops the sale of unlicensed enclosed arc lamps by the latter company and also involves the payment of damages by the defendant.

Four-Cent Car Fares in Cleveland.

Action was taken on Oct. 7 by the Cleveland Board of Control that insures a four-cent street car fare on two of the principal street car lines, and ultimately on all of the street car lines in Cleveland. The matter came up in the form of two ordinances, referred from the City Council, calling for a reduction of fare to four cents on the Cedar avenue and Kinsman street lines. The first of these lines is part of the two consolidated companies that own most of the street car lines in Cleveland, and the other is part of the other system.

ST. LOUIS is making war on the usurers who have been bleeding the telegraph operators in that city, exacting as high as 40 per cent. per month when they could get it.

SOCIETY & CLUB NOTES

American Institute of Electrical Engineers.

The 128th meeting of the Institute will be held at 12 West Thirty-first street, New York City, on Wednesday, October 26, 1898, at 8 o'clock p. m. A paper will be presented by A. A. Knudson, of New York City, on "An Electrical Survey in the Borough of Manhattan, New York City," showing results of stray current measurements between electrical railways, underground pipes, etc.; also results of tests on the Brooklyn Bridge.

New York Electrical Society.

By courtesy of the company, the 190th meeting of the society will be held at the Pearl Street Sub-Station, Brooklyn, of the Edison Electric Illuminating Company of that city, on Thursday, Oct. 27, at 7:30 p. m. sharp. After an address on the company's work by Mr. W. S. Barstow, chief engineer, a brief inspection of the station will be made. The rest of the evening will be devoted to a flying visit to the Sub-Station "A," (formerly the Citizens' Station), and the big Union Central Station at Bay Ridge. Special parlor cars will be ready to take the visitors from the Pearl Street Station, and on the return trip from Bay Ridge a collation will be served on the trolley train.

In returning, for the convenience of the New York members, the Brooklyn Heights Railway Company has kindly arranged to run the parlor cars to the New York end of the Brooklyn Bridge.

The Edison Electric Illuminating Company, of Brooklyn, has in operation a large three-phase central station (Union Station) located at Bay Ridge, from which multiphase current at 6,000 volts pressure is distributed to various sub-stations throughout the city, the distance from the main station to the sub-station varying from two to ten miles. At each sub-station is located the transforming apparatus necessary to convert the 6,000-volt, three-phase, energy, received from the main station, into energy of whatever form is desired by the substation for its distributing system. Thus the three-phase current is converted into energy suitable for the Edison three-wire low tension system, which is the main system of the Edison Company, by the use of step-down and rotary transformers. The same multiphase energy is also converted, at present, by synchronous motors, directly connected to Brush arc machines, into energy suitable for series continuous current arc lighting, and again the same multiphase energy by means of a frequency changer has its voltage, phase and frequency adapted to alternating distribution. Thus the energy generated at the Union Station is of what may be termed a universal type, readily convertible into whatever is desired by the customer, from energy suitable for the operating of the smallest surgical lamp or instrument to that adapted to propelling the heaviest street car or third rail train.

The Edison Company has throughout the one hundred and fifty square miles of its territory some ten sub-stations, from which it distributes current for supplying three thousand high tension street lamps, seven hundred low tension street lamps, six hundred high tension commercial lamps, one hundred and twenty thousand incandescent lamps, four thousand horse power of direct current motors and one hundred and seventy-five horse power of multiphase motors.

PERSONAL

MR. EUSTACE OXLEY, of Washington, D. C., has become associated with the engineering staff of the General Electric Company, at Lynn, Mass.

CAPT. G. N. STONE, general manager of the Bell Telephone Company, of Cincinnati, has returned home after a fortnight trip through the East. He was very much interested, as a street railway man, while in Boston, with the new trolley subway system.

MR. CHAS. E. PHELPS, JR., has been elected by the Elec-

Digitized by Google

trical Subway Commission of Baltimore, Md., chief engineer for the new subway system. He is a graduate of Johns Hopkins, and a practical engineer.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued October 11, 1898.

Batteries, Secondary:—

ELECTRIC BATTERY. M. E. Fuld, Baltimore, Md., 612,326. Filed Aug. 4, 1897. Embraces a method of sealing the cells and also a method of connecting the separate cells of a battery together.

Conductors, Conduits and Insulators:—

ELECTRICAL CONNECTOR. F. Schwedtmann, St. Louis, Mo., 612,-123. Filed Nov. 11, 1897. Consists of an inner cylindrical member having a smooth contact surface, an outer tubular member slit along a portion of its length to form a plurality of strips, and an annular spring for forcing the strips against the inner member, the annular member having its axis coincident with the axis of the tubular member.

CONDUIT OUTLET INSULATOR. F. W. Erickson, Boston, Mass. Reissued. 11,697. Filed Aug. 25, 1896. Composed of metallic insulating portions and having its outer end of insulating material flaring and means for securing the insulator to a conduit pipe.

Distribution:—

ELECTRICAL CONVERTER. F. Schwedtmann, St. Louis, Mo., 612,-122. Filed Aug. 28, 1897. Comprises a casing containing a main core supported by a frame resting on projections from the sides of the casing; and side chambers into which the coils of the core project through openings in the supporting frame.

ELECTRIC SYSTEM OF DISTRIBUTION. J. N. Thomas, Johnstown, Pa., 612,146. Filed Feb. 15, 1898. Underground system of distribution for electric railways.

Electro-Metallurgy:—

PROCESS OF ELECTROLYTIC SEPARATION OF METALS. H. Von der Linde, Crefeld, Germany, 612,250. Filed Nov. 19, 1897. A process for removing the plating from articles made of iron for the purpose of making the remaining iron capable of being used in the manufacture of steel.

Lamps and Appurtenances:—

ARC LAMP GLOBE. H. G. Mills, Milwaukee, Wis., 612,049. Filed May 10, 1897. Embodies a conical reflector mounted about the carbon holder.

Miscellaneous:—

PROCESS OF AND APPARATUS FOR ELECTROLYZING SEA WATER. G. B. Baldo, Triest, Austria-Hungary, 612,000. Filed Oct. 5, 1896. Means for obtaining caustic soda, hydrogen and chlorin, and for the separation of the magnesium and calcium in the form of oxids from the electrolytes and the sulfuric acid and hydrochloric acid developed during the process.

HINGE CONDUCTOR FOR ELECTRIC CURRENTS. F. E. Chandler, Brandon, Vt., 612,192. Filed Jan. 8, 1898. Embodies a hollow pintle, in combination with an electric conductor of unbroken continuity, the ends of which are secured to opposite wings of the hinge.

Railways and Appliances:—

TROLLEY ARM. B. P. Shopp, Jr., Jersey City, N. J., 612,062. Filed March 15, 1894. Consists of an elongated roller, and inclined guides located at each side of the trolley arm and inclining in the direction of the length of the roller.

SWITCHING MECHANISM. G. W. Singleton, Syracuse, N. Y., 612,-063. Filed Jan. 18, 1897. An electric switch operated by means controlled by the motorman of an approaching car.

ELECTRIC RAILWAY. F. D. Sweet, Elyria, O., 612,068. Filed Nov. 22, 1897. Surface contact system. Details of construction.

ELECTRIC TROLLEY DEVICE. C. L. Jeffrey, Johnstown, Pa., 612,-132. Filed Jan. 12, 1898. Comprises a central rotatable base having horizontal arms, a trolley-arm hinged to one end of the horizontal arms, a lock at each end of the arms for preventing lateral movement and means for simultaneously releasing both of the locks.

CASING FOR ELECTRIC CAR LIGHTING APPARATUS. W. F. Richards, Buffalo, N. Y., 612,139. Filed Nov. 26, 1897. A casing for exposed parts of that class of electric car-lighting apparatus in which the current is generated by a dynamo driven by a belt from one of the car axles.

ELECTRIC TRACTION APPARATUS. R. Demeuse, Brussels, Belgium, 612,234. Filed July 23, 1897. A surface contact for closed conduit electric railways.

TROLLEY POLE. V. A. Mason, Austin, Tex., 612,255. Filed April 20, 1898. Provides a construction whereby the pole may yield laterally to conform to curves and also yield vertically at its upper end to pass hangers and other obstructions on the wire.

UNDERGROUND ELECTRIC RAILWAY. C. W. Jenkins, Richmond, Va., 612,344. Filed Oct. 28, 1897. Comprises a conduit provided with transverse insulating beams for the insulators; the insulators to be supported by and arranged alongside the beams.

TROLLEY WHEEL SUPPORT. E. Lane, Johnstown, Pa., 612,351. Filed June 28, 1897. The wheel supporting bar is insulated from the frame which carries it, connection being made between the trolley wheel and a bar beneath.

Switches, Cut-Outs, Etc.:—

LIGHTNING ARRESTER. C. C. Chesney, Pittsfield, Mass., 612,015. Filed Jan. 15, 1898. A coil having portions reversely wound in close proximity to each other, is placed between the lightning arrester and the apparatus to be protected.

ELECTRIC SWITCH. G. W. Hart, Hartford, Conn., 612,038. Filed Oct. 23, 1896. Embodies a cup-shaped base, having in its outer walls, open grooves leading from the bottom of the base to the contacts.

ELECTRIC LAMP SOCKET. F. M. Bell, New York, 612,152. Filed Jan. 10, 1898. Comprises a casing, a base of insulating material arranged therein, a central contact and contact fingers arranged upon the base, and a spiral supported by the contact fingers.

CONTROLLING SWITCH FOR ELECTRIC MOTORS. R. Hutchison, Mobile, Ala., 612,208. Filed Feb. 17, 1898. Designed for use on trolley cars. Details of construction.

RHEOSTAT. E. O. Raster, Chicago, Ill., 612,212. Filed April 11, 1898. Comprises a frame adapted to receive a plurality of sets of resistances, each of which comprises a plurality of resistance sticks alternated with contact and insulating pieces.

Telephones:—

TELEPHONE ARM-REST. J. R. McKelvey, Lawrenceville, Ga., 612,-172. Filed Aug. 23, 1897. A pivotally supported bracket forming a combined arm-rest and advertising device.

TELEPHONE CENTRAL STATION APPARATUS. J. H. West, Berlin, Germany, 612,219. Filed July 8, 1896. "Busy" signals for multiple switchboards.

CIRCUIT CONTROLLER AND RECEIVER SUPPORT. L. Duque, Paris, France, 612,236. Filed Aug. 21, 1897. Details of construction.

TELEPHONE PAY STATION. W. Gray, Hartford, Conn., 612,330. Filed Nov. 21, 1895. Comprises a signal device, a hollow conducting post, a transmitter case pivotally attached to the post, and a curved deflector tube rigidly attached to the transmitter case and extended within the post through an opening in the wall thereof.

Classified Digest of U. S. Electrical Patents Issued October 18, 1898.

Alarms and Signals:—

ELECTRIC SIGNALING APPARATUS. W. E. Decrow, Boston, Mass., 612,708. Filed Dec. 27, 1897. Comprises a train, a box-number-circuit-operating device operated by it to transmit a box-number signal at different speeds at every operation of the train, and an actuating lever for the train.

ELECTRIC TIME ALARM. H. D. Tenny, Milford, Mich., 612,441. Filed Feb. 19, 1898. Details of construction.

ELECTRIC SIGNALING APPARATUS. W. E. Decrow, Boston, Mass., 612,709. Filed Jan. 4, 1898. Similar to above.

Batteries, Secondary:—

BATTERY ELECTRODE. H. S. Lloyd, Philadelphia, Pa., 612,649. Filed Sept. 20, 1897. Comprises a frame of practically non-active alloy, and thin parallel strips of metallic lead (adapted to become in action the active material) free from interposed paste, the strips being horizontally supported in the frame, electrically connected therewith, and having reinforced outer edges to lengthen the life of the strips in the process of peroxidation.

Conductors, Conduits and Insulators:—

SYSTEM FOR INSULATION OF ELECTRIC CONDUCTOR WIRES. J. H. Vail, Philadelphia, Pa., 612,535. Filed Feb. 26, 1898. Comprises an insulating-covering for a portion of the conductor consisting of a plurality of sleeves, one within another, each sleeve being split, and having its line of division breaking joint with the joint of the adjacent sleeve.

ELECTRIC CABLE SWITCH. A. Norman, Toronto, Canada, 612,670. Filed April 19, 1897. Details of construction.

Electro-Metallurgy:—

PROCESS OF SIMULTANEOUSLY PRODUCING CARBIDS AND METALS OR ALLOYS. H. Aschermann, Cassel, Germany, 612,694. Filed March 30, 1898. Consists in mixing carbon with an oxygen compound and a sulfid of metals having different affinities for carbon, and heating the mixture electrically.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. C. A. Vigreux and L. V. Brillie, Levallois-Perret, France, 612,556. Filed March 30, 1898. The essential feature consists in the brake being rotatable around the axis of the flywheel and in being so arranged that the regulation is entirely independent of the coefficient of friction of the contact.

ELECTRIC LAMP SOCKET, J. E. Criggal, Newark, N. J., 612,560. Filed Nov. 4, 1897. Comprises a non-conducting socket-base, having spiral conducting wires sealed into it, and forming at their outer ends a helical holder, and each having at its inner end a threaded spiral eye open at one side and forming a single turn and constituting a binding-post.

Measurements:—

ELECTRIC METER. W. D. Marks and G. R. Green, Philadelphia, Pa., 612,426. Filed Jan. 10, 1898. Consists of a controlling-arch the position of which is determined by an ampere indicator, a pawl-carrying lever and co-operating with the arch and effecting the registration, a shaft extending through the arch, a driving cam carried by the shaft for actuating the pawl-carrying lever, and a motor for driving the shaft.

ELECTRIC METER CASE. W. D. Marks, Philadelphia, Pa., 612,427. Filed Jan. 10, 1898. Comprises a box carrying a frame upon its front secured to its lower wall, a screw for connecting the upper part of the frame to the upper wall of the box, and a seal for the screw.

ELECTRIC METER OR INDICATOR. W. D. Marks, Philadelphia, Pa., 612,781. Filed Feb. 7, 1898. An ampere indicator in which the actuating coils are combined with a permanently magnetized movable member and an extra winding on the movable member.

Railways and Appliances:—

ELECTRIC TROLLEY DEVICE. A. J. Gairing, Johnstown, Pa., 612,-410. Filed Aug. 3, 1898. Comprises a single transverse torsion-spring secured to each end on the vehicle and a contact-carrying arm having its lower end secured about the central portion of the spring.

ELECTRIC RAILWAY. C. H. Meyers, Buffalo, N. Y., 612,457. Filed Aug. 18, 1897. Comprises a third rail conductor and protective appliance therefor.

DEPRESSIBLE RAIL SYSTEM FOR ELECTRICAL RAILWAYS. W. Grunow, Jr., Bridgeport, Conn., 612,644. Filed July 10, 1897. Consists of a conduit, beams extending across the conduit, yokes upon the beams provided with curved arms, and slot rails enclosing the yokes and provided with an attaching-flange along one edge and having an engaging rib along the free edge to overlap the extremities of the yoke-arms and form a slot.

RAIL-JOINT FOR ELECTRIC RAILWAYS. M. Barschall, Berlin, Germany, 612,696. Filed March 14, 1898. Employs an auxiliary rail supported by the sleepers and a conductor connecting both jointed track-rails and placed in the space between the track-rails and the auxiliary rail.

AUTOMATIC ELECTRICALLY CONTROLLED RAILWAY SWITCH. R. V. Cheatham, Louisville, Ky., 612,702. Filed March 12, 1898. Details of construction.

ELECTRIC SELF-LOADING STREET-CLEANING CAR. A. J.

Digitized by Google

Reynolds, Worcester, Mass., 612,789. Filed Feb. 2, 1897. Employs an independent motor to operate the brush.

Regulation:—

MEANS FOR CONTROLLING OPERATIONS OF ELECTRIC MOTORS. J. D. Ihlder, Yonkers, N. Y., 612,629. Filed Jan. 26, 1898. With the motor is combined a resistance included in the circuit of the motor, and a series of electromagnets automatically operated according to the varying potential of the motor-armature arranged to control the resistance.

Telephones:—

TELEPHONE EXCHANGE MECHANISM. H. P. Snow, Erie, Pa., 612,681. Filed Nov. 1, 1897. Automatic telephone exchange system. Details of construction.

COIN-ACTUATED SIGNAL APPARATUS. H. R. Mason, Ludington, Mich., 612,782. Filed Dec. 31, 1897. Telephone.

THE STOCK MARKET

Exports Large and Gold Imports.

TRADE in general continues excellent, with favorable reports from all parts of the country, even in the South, where cold weather has lifted the quarantines. What is most striking is the enormous export of cereal products, for present and future delivery, freights going up sharply in consequence. Gold is still coming in despite higher discount rates abroad, and the Klondike output alone for the year is put officially at $8,000,000.

While prices have been firm on the Stock Market, transactions have been checked by the strained relations between England and France, and thus sales and bank clearings have been lower. During the week, 3,766 shares of Western Union were sold at 90¾ up to 91¾. Of General Electric, 3,368 shares were sold from 77¼ up to 78½. New York Edison sold 550 shares, from 124½ up to 126½. On sales of 33,623 shares, Metropolitan Street Railway went off from 162½ to 159¾. In Boston, Bell Telephone sold down to 277 and West End Railroad was firm at 86, both on very small sales.

Advices from Chicago say: "The local stock market has been very dull for several weeks. The most noted feature of late was the advance in Chicago Edison. For many weeks it has been in the neighborhood of 140. This week it sold at 160, 100 shares changing hands at that price. This makes an advance of 2½ points as compared with the price at which the last previous trade was recorded a few days before, and a gain of 30 points since just before the announcement that the Commonwealth Electric deal had been closed. The point of 160 is the highest at which the stock has sold since 1893, when it sold at 200. Except during 1893 it never broke above 160, though it just touched that point in 1891 and again in 1892. Not only does it practically control all the electric lighting business in Chicago—the Commonwealth is owned by Chicago Edison interests—but with reference to future competition it stands in quite as safe a position as does the People's Gas Light and Coke Company. The frontage bill, passed by the last Legislature, is as much a protection to the Chicago Edison as to the People's Company."

Copper, New York, is 12½ cents; heavy steel rail, Eastern mill, is $18.

Water and Power Famine at Norway, Me.

A special dispatch from Norway, Me., of Oct. 19, says: The electric power plant failed to furnish power last night because the water is too low to run the motors. Streets, stores, residences and other places in this village and South Paris were in darkness. The Supreme Court had to borrow kerosene lamps. Street cars were stalled in Main street. The large shoe factories, newspaper offices, mills and other manufacturing plants are temporarily without power. The water system of the twin villages, which depends upon electric power, is threatened.

MR S. INSULL, president of the Chicago Edison Co., gave a complimentary dinner on Oct. 15, at the Union Pacific Hotel, to several of the employees of the Company who had taken part in the war with Spain. Out of the sixteen who enlisted under the flag, nine were guests on this interesting occasion. Over 150 sat down, and a delightful evening was spent.

TRADE NOTES AND NOVELTIES

McIntyre Miner's Lamp.

THERE has recently been devised a portable electric safety lamp for use in special cases when an open flame or even one safeguarded, as in the miner's lamp, would prove dangerous. The combination consists of a dry battery arranged to be carried in a holder at the belt, or in the pocket. The battery is controlled by a small rheostat, maintaining an even supply of current to the lamp and allowing it to burn with the same brilliancy during the life of the battery. Changing an exhausted for a new battery involves no electrical knowledge. The electric lamp, connected to the battery by a flexible cord, is the miners' lamp manufactured at the Edison lamp works of the General Electric Co. It is of six c. p., and is set in a small white enameled parabolic reflector, provided with a stick pin to allow it to be attached to the hat or any part of the clothing. The light is strong enough to allow ordinary printed matter to be read at a distance of 100 feet from the lamp.

The combination is manufactured by Elmer E. McIntyre, of Pittsburg, and has been found very useful by gas inspectors in reading meters in dark cellars; by repair men exploring cellars and trenches for gas leaks and defective pipe connections, or examining gaseous sewers; by miners and mine inspectors in gaseous mines, where the risk of explosion even from the miners' lamp is ever present; by watchmen in powder mills and warehouses storing inflammable oils and essences, or by workmen repairing oil and gas tanks or examining the rivetting inside steam boilers. This lamp is especially valuable as it leaves the hands free, and its weight is so small—about two pounds—as to be hardly noticeable.

Micanite Commutator Rings.

The Mica Insulator Co., of New York, Chicago and London, manufacturers of "Micanite" materials for high grade insulation, report a gratifying demand for their commutator rings.

They make a specialty of manufacturing molded insulation and are now turning out, for some of the large manufacturers of electrical machinery, molded rings, all in one piece. This pattern of ring is the most difficult insulation to manufacture; but the ring, as it comes from the machinery of this company is as perfect as a stamped piece of steel ware, and has the same metallic note. Electrical manufacturers will do well to write the company, sending their blue-prints for estimates.

Another form of insulation of which they have made a specialty, is the armature trough or slot, which is now in use by many of the manufacturers of motors for crane work, and by those who require a heavy insulation, which will stand at very high voltage.

Raster Carbon Rheostats.

WE are indebted to Mr. W. R. Garton, consulting engineer of the Raster Carbon Rheostat Company, of 231 South Canal street, Chicago, for the subjoined interesting data as to their business.

The Raster Carbon Rheostat Company, have but a short time been in position to offer to the trade a full line of controllers, starters and regulators; but although they have had these devices on the market but a short time, their orders for rheostats of various kinds are now running into the thousands of horse power. All of their devices are manufactured under patents which they control. Their automatic release for motor starters is manufactured under the Jenney patent. Many people who are skeptical as to the advisability of using carbon for resistances have, after having been placed in possession of the facts, become their warmest friends and from such people they are receiving duplicate orders continually.

The company have lately made some very handsome rheostats which have been shipped to Europe and Australia. All of the Raster rheostats are radically new in design. Their method

Digitized by Google

of assembling their resistances and the construction of their devices are all original. They have been obliged to make some very radical changes in their factory to enable them to fill their orders with promptness, so great has been the rush. They make a great point of prompt delivery and many patrons have been won by the attention given to the trade and the methods practiced by this company. They have lately secured some very nice theatre dimmer orders and feel very much gratified, over the results they are obtaining.

The Raster Company state, for the benefit of those who think that they would invest the money they have in such a business without having covered the field fully with patents, that all of their appliances are fully covered, not only in America, but in all countries on the globe, so that they are prepared to handle and protect business from any source whatever.

Western Electrical Supply Co.'s New Telephone Battery.

WE illustrate and describe herewith the new telephone battery of the Western Electrical Supply Company, of North Ninth street, St. Louis, believing that telephone managers would find it to their interest to investigate the merits of this battery, which was especially designed for telephone work. Besides the general construction and points of advantage which it possesses and qualifies it for this particular class of work, we might mention a few of the minor details that are so often overlooked, but which are very often the redeeming features of a battery.

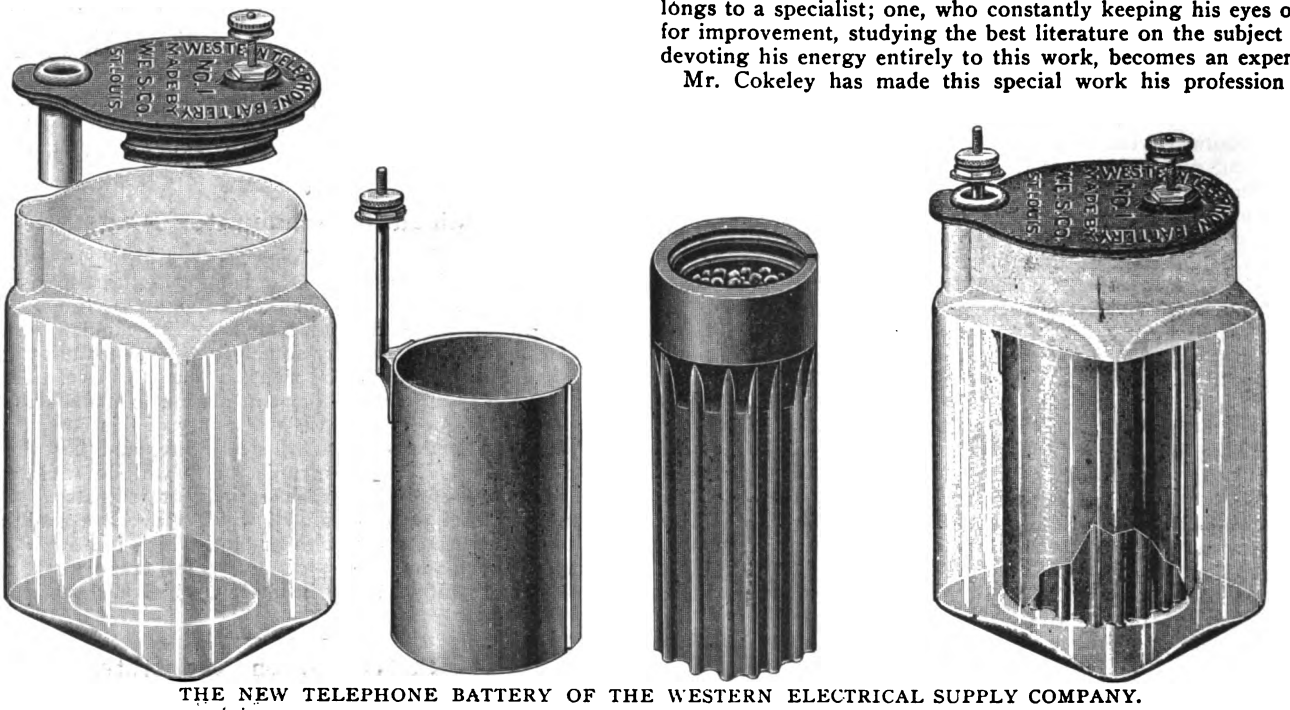
One of the minor details referred to is that the carbon binding post does not protrude through the carbon, thus allowing corrosion to gradually ruin the connection, but is screwed in from the top, until perfectly firm, and then made secure by hot solder being poured around it. This makes a connection that cannot possibly corrode, and one that is impossible to ever work loose.

It will also be noticed from the cut showing the sectional view, that the carbon cylinder is not filled with a granulated carbon and oxide of manganize from the bottom of the carbon and then sealed, but is screwed to the cover in such a manner that it may at all times be easily removed and refilled. This as will be noticed is a very redeeming feature, and in itself should make it not only one of the most convenient, but one of the best batteries in the market to-day.

The carbon used in this battery is of selected stock, and no pains have been spared in making the selection to procure a carbon that is especially adapted to this class of work. The workmanship is also another consideration, as the parts are all carefully constructed and put together in a most desirable manner. It will be noticed from the cut of the zinc as shown in the illustration, that the rod which protrudes through the cover is mounted on the cylinder zinc in such a manner that it cannot possibly become loosened, as a shoulder is placed upon the zinc so as to hold it firmly in position.

The cylinder zinc also is rolled from a very heavy zinc, which naturally gives it an unusually long life, and is also of a very high standard. The cover of the battery is made of one sold piece of carbon, so thoroughly saturated with paraffine while still warm from the ovens, that it is absolutely an impossibility for the salts to creep over the top and corrode the connections. The zinc rod protrudes through this carbon by means of a porcelain tube, which acts as an insulator, and helps to give life to the battery. The glass jars are not made of the ordinary green glass, but are on the contrary, made from the purest white flint glass that can be obtained, which makes them not only tough and unlikely to break, but presents a very neat appearance.

This battery has just been brought out by the Western Electrical Supply Company, of St. Louis, Mo., and has many other redeeming features, worthy of consideration.



THE NEW TELEPHONE BATTERY OF THE WESTERN ELECTRICAL SUPPLY COMPANY.

C. W. Hunt Co.

Mr. M. Cokeley, who is probably known to many of our readers, has been made superintendent of the works of the C. W. Hunt Co., Staten Island, N. Y., assuming the duties of that position Oct. 14, after several months' work revising the factory systems. Large concerns are beginning to relieve the office management of the providing for the details in office routine, the installation of systems, methods, etc. This work properly belongs to a specialist; one, who constantly keeping his eyes open for improvement, studying the best literature on the subject and devoting his energy entirely to this work, becomes an expert.

Mr. Cokeley has made this special work his profession for some time, being for many years with the General Electric Company, and later with other prominent firms. His experience as a practical mechanic has been of great benefit in his line of work, enabling him to detect almost instantly the leaks that invariably develop and which are so destructive to profits.

Hitched His Wagon to a Star.

The entire plant of the Fish Bros. Wagon Company at Racine, Wis., has been equipped with electrical transmission of power and light. The switchboard placed in the plant is one of the largest electrical marble switchboards in the northwest and is said to be the acme of perfection. The entire equipment was furnished and put in by the Julius Andrae & Sons Co., of Milwaukee, Wis.

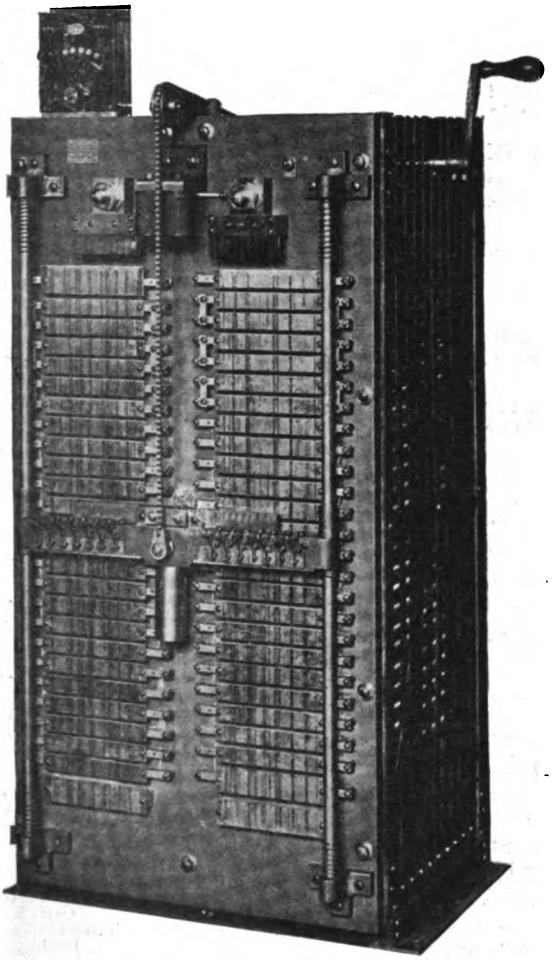
The Andrae Company's new catalogue of telephones and electrical supplies is now ready for distribution and will be sent to any address free of charge.

Digitized by Google

Cutler-Hammer 500 H. P. Starting Box.

THE cut below shows a 500-horse-power, 500-volt starting box, which has been in successful operation for several months. This starting box is provided with the magnetic release, and has, in addition to its unusually large size, several interesting features. The segments are all made of hard rolled copper, and are interchangeable and easily renewed without disturbing any of the electrical connections.

The starter is provided with 50 segments, thereby enabling the flow of current to be increased in quite small increments and



500 H. P. 500 V. STARTING BOX MADE BY THE CUTLER-HAMMER MFG. CO.

thus practically entirely eliminating all sparking. Notwithstanding this large number of segments no lead wires whatever are used, the resistance being connected directly to independent segments placed underneath the copper segments.

For the sake of comparison, a ¼-horse-power starting box is shown, resting on top of the 500-horse-power box. This starting box is probably the largest ever manufactured, and was built by the Cutler-Hammer Manufacturing Company, of Chicago, who have made the building of starting boxes a specialty for the past five years.

The Advantages of Mechanical Draft.

The peculiar advantages of mechanical draft are very clearly displayed in the following quotation from a paper presented by Mr. Alfred Blechyden before the British Institution of Mechanical Engineers and presented in the recently issued Treatise on Mechanical Draft published by the B. F. Sturtevant Company, of Boston, Mass. Mr. Blechyden says: "First, it seems fairly well established that, if the boilers are well constructed and are provided with ample room to insure circulation, their steaming power may without injury be increased to about 30 to 40 per cent. over that obtained on natural draft for continuous working, and may be about doubled for short runs. Secondly, such augmentation is accompanied in normal cases, by an increased consumption per indicated horse power. But, thirdly, the same or even greater power being indicated, it may, with moderate assistance of forced-draft, be developed with a smaller expenditure of fuel, the grates, etc., being properly proportioned. Fourthly, forced draft enabled inferior fuel to be used; and, fifthly, under certain conditions of weather, when with normal proportions of boiler it would be impossible to maintain steam with natural draft, the normal power may with forced draft be insured. In particular cases any or all of these advantages may be a source of economy; and the first of them may render possible that which would otherwise be impracticable."

Baldwin-Westinghouse Mine Locomotive.

In a recent letter to the Westinghouse Electric & Manufacturing Company, Mr. R. G. Vance, Jr., superintendent of the Stevens Coal Company, makes the following statements regarding the Baldwin-Westinghouse electric mine locomotive in operation in their mines: "It affords us pleasure to say that this motor is giving the very highest possible satisfaction and is attracting considerable attention in this valley. It has been running since May 1, and has not cost a dollar in the shape of repairs, excepting a new valve for sand box and a headlight base broken in a collision with a car. It is running on a road of 25-pound steel rail, 4,000 feet long, over undulating grades varying from 1 to 6 feet per 100 feet. Its regular load now consists of 20 cars of 1½ tons capacity, and the time required for each round trip is from 17 to 19 minutes. We have pulled as high as 25 of these cars at one trip, which it did with all ease. When necessity requires we can pull 30 cars, giving 50 per cent. more capacity than you guaranteed." This is evidence of the superior qualities of this mining locomotive, which is characteristic of the work done by the Baldwin and Westinghouse companies.

The Iron Clad Resistance Co.

THE above named company has been organized with R. H. Mansfield, Jr., as President; A. W. Berresford, as Vice-President, and A. P. Munning, as Secretary and Treasurer. It has bought up all the plant, patents, assets, real estate, etc., of the old Iron Clad Rheostat Co., and will carry on its business at the factory at Westfield, N. J. It proposes to push business actively and vigorously, and is already in the field with its specialties. Mr. Mansfield, the president, is a graduate of the Massachusetts Institute of Technology. He was assistant superintendent of electrical construction for H. Ward Leonard & Co., and then went South for W. R. Fleming & Co., where he had charge of installing several electric light plants. In May, 1895, he became one of the principal officers of the Carpenter-Enamel Rheostat Co., and so continued until recently with its successor, the Ward-Leonard Electric Co. He is familiar with all the details of the design, manufacture and trade handling of rheostats, as well as acquainted with the electrical field in general. Mr. A. W. Berresford is a graduate of the Brooklyn Polytechnic Institute and of Cornell. He went with the Brooklyn City Railway in 1893 in the department of equipment and repairs. He was later with the Riker Electric Motor Co., designing and testing, and later had charge of the details of designing and testing for the Carpenter and Ward-Leonard companies. Mr. A. P. Munning has had over nine years' experience in the electrical field, going first with the United Edison Co., in Chicago, in 1888, holding on through the various changes until 1892. He then took a position in the electrolytic department of the Anaconda Mining Co., Montana, and in 1894 entered the field of rheostat manufacture, becoming assistant under Mr. Mansfield. This is an independent company, and has absolutely no connection with any other house in their line.

The new company, in their announcement to the trade, say: "Knowing from actual and exhaustive tests that the 'Iron-Clad' type of rheostats and resistance plates, when properly constructed, possess many points of advantage over any style of rheostats in the market, and believing that a responsible concern offering first class apparatus and proper business treatment will meet with the approval and good will of the electrical public and users of rheostats generally, this company invites your cordial co-operation and support."

FIRE IN HAVANA. On Oct. 17 the central telephone exchange was destroyed by fire.

Digitized by Google

ADVERTISERS' HINTS

THE WESTERN ELECTRIC CO., Chicago and New York, are introducing an electric heater especially designed for heating small offices, bathrooms, street railway waiting rooms and the summer villa. It is perfectly clean, does not vitiate the air and is portable. It is finished in several styles.

THE ELECTRIC APPLIANCE CO., 242 Madison street, Chicago, Ill., in speaking of the Packard transformer, say: "We do not claim results, but guarantee them." In the model '98 Packard transformer the manufacturers have spared neither effort nor expense to place before the trade a transformer which will be equal to the best of either European or American manufacture.

THE EDISON LAMP WORKS, Harrison, N. J., state that it is about time to look up means to supply miniature and decorative lamps for holiday decorations. They are prepared to make prompt deliveries.

SCHIFF, JORDAN & CO., 232 Greenwich street, New York, continue to supply special carbons for direct and alternating current long-burning arc lamps, searchlights, etc. Their prices will be mailed on application.

THE WASHINGTON CARBON CO., Pittsburg, Pa., have opened a Boston office in the Tremont Building, in that city.

THE MICHIGAN PIPE CO., Bay City, Mich., advertise creosoted wood conduits for underground wires. They say that these will last forever, are reasonably accessible, do not gather moisture and do not scratch cables.

BIBBER-WHITE CO., 49 Federal street, Boston, Mass., have purchased a glass plant for manufacturing insulators under the standard mark "B.-W. Co.," and they desire to close out about one-quarter of a million insulators not so marked at a material reduction from the current price. The lot consists of standard pony, double petticoat pony regular, and deep grooved double petticoat.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., advertise a power service system for machine driving. They illustrate a Westinghouse motor operating a rotary planer.

THE WEBSTER CHEMICAL CO., 400 Sibley street, St. Paul, advertise lamp colors in a great variety of shades, and also ground glass and opal white effects.

THE STANDARD THERMOMETER & ELECTRIC CO., Peabody, Mass., claim to manufacture the best arc lamp on the market, and they state their reasons for making this claim.

THE WAGNER ELECTRIC MFG. CO., St. Louis, Mo., submit a curve illustrative of the performances of their transformers. They state that they will undertake to put central stations on an economical basis of operation.

NEW YORK NOTES

LIVE ELECTRICAL SUPPLY HOUSES would do well to communicate with the St. James Electric Co., 1133 Broadway, and get information regarding their portable electric burglar alarm. It is a good seller when properly canvassed, and is a most successful and ingenious device. Any traveling salesman would also find it a valuable little side line. It was fully illustrated in our columns last week.

AN ATTORNEY'S STANDING may be judged by the kind of clients he has. Mr. E. P. Thompson, solicitor of patents, 83 Fulton street, New York, has served fifteen well-known professors. During his professional career he has been manager of two patent agencies, besides developing his own large business in this field.

TELEPHONE AGITATION. Mr. R. M. Walters, of the Telephone Committee of the Board of Trade, has objected to the payment by the city of $73,719 for the telephone service. He wants a system owned and controlled by the municipality.

NEW YORK EDISON COMPANY for September shows gross earnings of $230,123 and net of $106,425. The net since Jan. 1 is $908,377, an increase of $142,522 over 1897.

HUEBEL & MANGER, 286-290 Graham street, Brooklyn, N. Y., are sending out their new catalogue which contains all their new and improved articles in electrical and brassware lines. The quality of their goods has been kept up to its high standard and the prices are up to date. Good goods, such as theirs, at moderate prices get the trade and hold it.

WESTERN NOTES

CARD ELECTRIC CO. Mr. S. N. Ford, the receiver of the Card Electric Co., of Mansfield, O., reports that while nothing has been done yet looking to the reorganization of their business, they are running with full force and have more orders than they can fill promptly. "We have been compelled to work 90 days and longer for delivery on present quotations, and with that time have great difficulty in getting work through fast enough."

WASHINGTON CARBON CO. have opened a branch office at 524 Tremont Building, Boston, and have appointed Mr. M. A. Lawton & Co. their representatives in New England. The office and work will be in charge of Mr. H. T. Edgar, who is the president of M. A. Lawton & Co.

CONTENTS.

EDITORIALS:
The Electric Motor Before the B. A. 410
Telephone Disturbances from Electrical Generators 410
Uncle Sam Needs More Room 411
The Pecuniary Value of Fine Scenery 411

MISCELLANEOUS:
The Current Strength of a Lightning Stroke (illustr.) .... Alex. J. Wurts. 401
Is This a Curious Lightning Stroke? (illustr.) 401
The Paris Exposition of 1900 and Its Leading Features (illustr.) .. 402

TELEPHONY AND TELEGRAPHY:
Limiting Distance of Telephone Speech and the K. R. Law (illustr.) .... A. E. Dobbs. 406

MUNICIPAL AFFAIRS:
Some Views and Data on Municipal Ownership—III .... Henry Hopkins. 407

POWER TRANSMISSION:
A Novel Power Transmission Scheme for West Superior, Wis. (illustr.) 408

ELECTRIC LIGHTING:
Illumination in Boston and Providence Department Stores by Enclosed Arcs (illustr.) 408
Knight Templar Illuminations at Pittsburg 409

ELECTRIC TRANSPORTATION:
Electric Canal Haulage (illustr.) .... A. H. Allen. 412
Improved Shop Methods on the Calumet Road, Chicago .... J. R. Cravath. 413

NEWS AND NOTES:
The Electric Arch at the Chicago Peace Jubilee (illustr.) 414
The Pittsburg Type "K" Transformer (illustr.) 415
Methods of Determining the Frequency of Alternating Currents .. Carl Kinsley. 416
Twentieth Triennial Exhibition of the Massachusetts Charitable Mechanic Association, Boston, Oct. 10 to Dec. 3, 1898 416
Water and Power Famine at Norway, Me.—A Trolley Road for Honolulu 421

MECHANICAL:
Jones & Laughlin, Ltd., and the Production of Steel—II 417

LITERATURE:
Eberle's "Kosten der Krafterzeugung" 418
Lehmann's "Die Elektrischen Lichterscheinungen Oder Entladungen" 418

LEGAL NOTES:
Jerking of Trolley Cars at Starting Is Negligence 418
Enclosed Arc Lamp Decision: The Marks and Ransom Patent Sustained.—Four-Cent Car Fares in Cleveland 419

SOCIETY AND CLUB NOTES:
American Institute of Electrical Engineers.—New York Electrical Society 419

PERSONAL:
Mr. Eustace Oxley.—Capt. G. N. Stone.—Mr. Charles E. Phelps, Jr. 419

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Oct. 11, 1898 .. 420
Classified Digest of U. S. Electrical Patents, Issued Oct. 18, 1898 .. 420

THE STOCK MARKET:
Exports Large and Gold Imports 421

TRADE NOTES AND NOVELTIES:
McIntyre Miner's Lamp (illustr.).—Micanite Commutator Rings.—Raster Carbon Rheostats 421
Western Electrical Supply Co.'s New Telephone Battery (illustr.).—C. W. Hunt Co.—Hitched his Wagon to a Star 422
Cutler-Hammer 500 H. P. Automatic Starter (illustr.).—The Advantages of Mechanical Draft.—Baldwin-Westinghouse Mine Locomotive.—The Iron Clad Resistance Co. 423
Advertisers' Hints.—New York Notes.—Western Notes 424

Department News Items will be found in advertising pages.

Digitized by Google

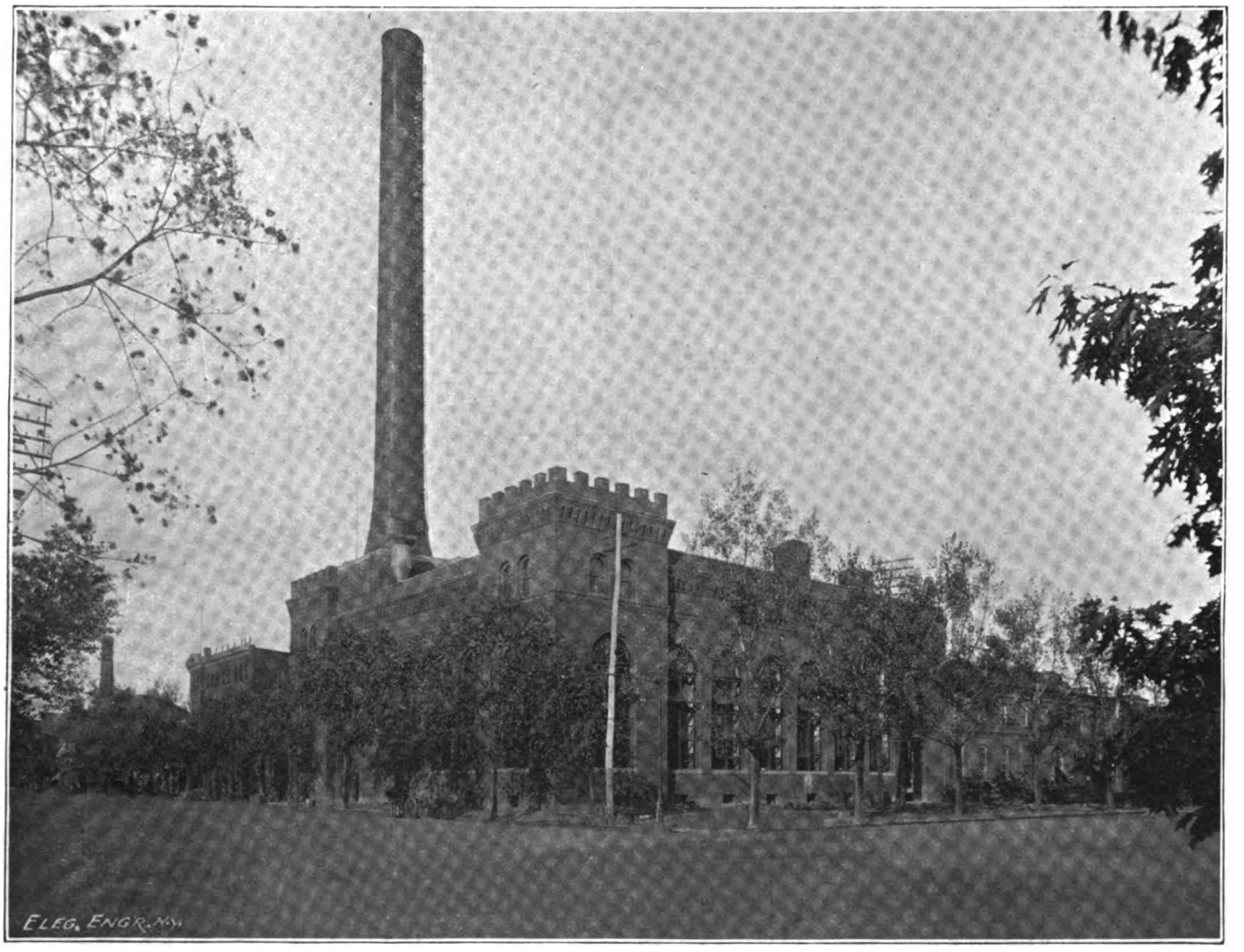
The Electrical Engineer.

Vol. XXVI. NOVEMBER 3, 1898. No. 548.

THE UNITED STATES ELECTRIC LIGHTING COMPANY OF WASHINGTON, D. C., AND ITS NEW ELECTRICAL EQUIPMENT.

BY NEVIL MONROE HOPKINS, E. E.

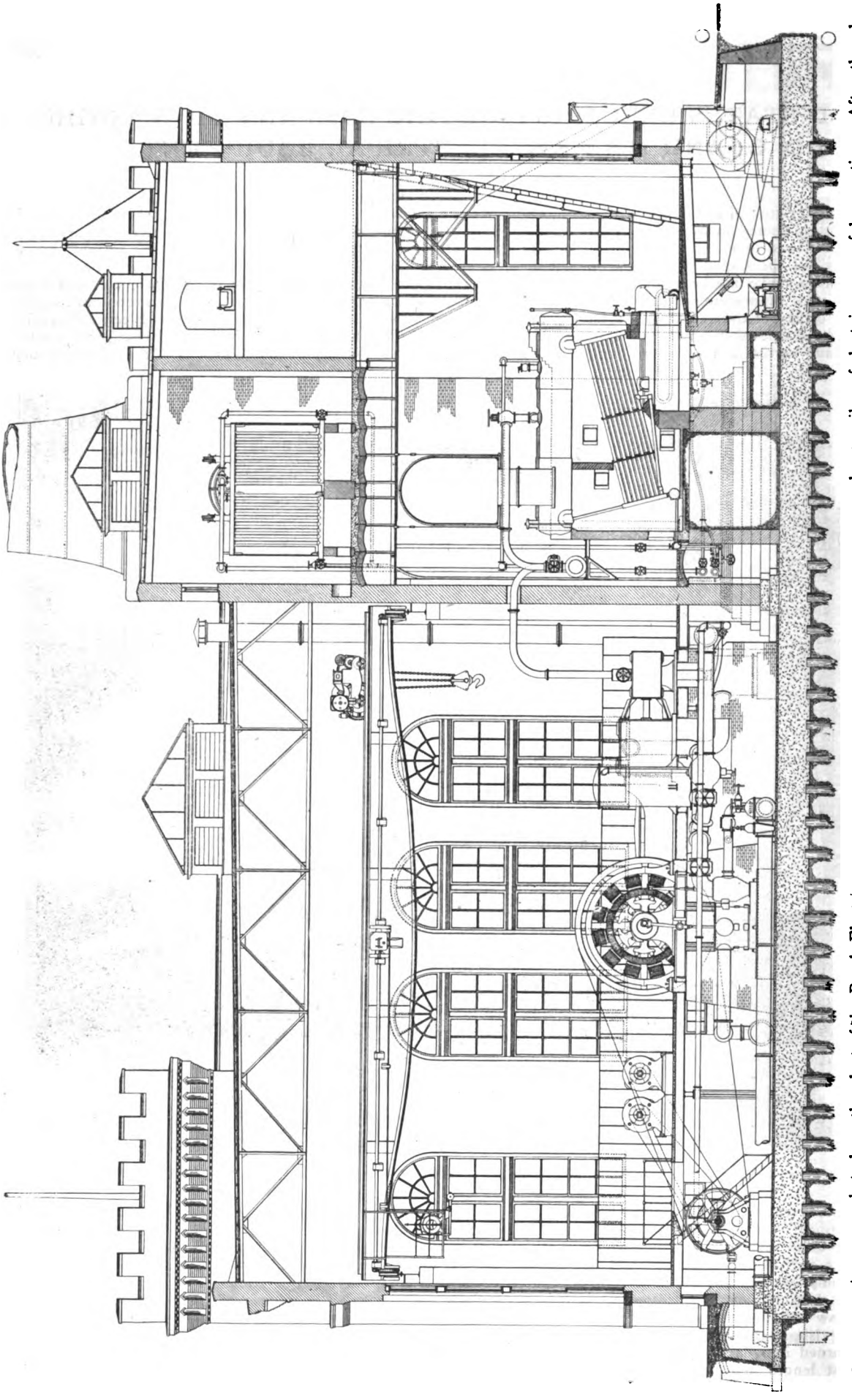
IN the fall of 1881, the survivors of the Army of the Cumberland and their friends gathered in Washington to dedicate their statue of General Thomas, then just erected in one of the most prominent "circles" of the Capital City. The people of Washington contributed to make the occasion as memorable as possible, and committees of prominent and public spirited citizens were formed to carry out the various plans for the entertainment of the visitors. One of the most novel and attractive schemes proposed and carried out was the illumination of the famous Pennsylvania avenue, from the Peace Monument to the Treasury Department, with the electric arc light, then just appearing in a few cities, but entirely unknown in Washington. Guy wires were stretched at intervals from house top to house top, and arc lamps were suspended therefrom over the middle of the street. A dynamo electric machine was belted to an engine in a nearby saw mill, and at the appointed time thousands of residents and visitors thronged the broad thoroughfare to behold night turned into day. Owing to the primitive apparatus, and the vast length and breadth of Pennsylvania avenue, the display was rather indifferent, as can be imagined, but the interest it aroused in electric lighting, among certain members of the committee, having the matter in charge, was not allowed to die out, and a corporation was formed, known as the Heisler Electric Light Company. This company experienced considerable difficulty in building a plant, and maintaining a service, and in November, 1882, transferred all its properties and franchises to the United States Electric Lighting Company, of Washington. New capital and energy were introduced in the persons of Messrs. Widener, Elkins, and Maloney, of Philadelphia, and Mr. George W. Hebard, of New York. An entirely new electrical equipment of the Weston system was installed, and at the first annual meeting held in November, 1883, it was reported that ninety-one arcs and one hundred incandescent lamps were in operation.



NEW POWER HOUSE OF THE U. S. ELECTRIC LIGHTING COMPANY, WASHINGTON, D. C.

Such was the small beginning of the company whose magnificent new central station forms the theme of this article. The company has made a great deal of interesting history. Among the casualties encountered in the growth of the plant, may be mentioned the fire which, on the night of July 16, 1885, totally wrecked the entire station. During the progress of the flames,

Digitized by Google



SECTIONAL VIEW, NEW POWER HOUSE, U. S. ELECTRIC LIGHTING COMPANY, WASHINGTON, D. C.

arrangements were made to lease the plant of the Brush Electric Light Company, then aspiring to be a competitor. A new equipment was immediately ordered, and within two weeks, the principal circuits were again in operation. The company took an early and farsighted interest in underground construction, having laid in 1884 at great expense, a service along Pennsylvania avenue, using a sealed up conduit system then well known in England and this country. It was among the first to adopt the terra cotta conduit system, and to-day has 44 miles of conduits, and 147 miles of duct in successful operation. After the absorption of the Brush Company, rivalry was soon threatened by the pushing and energetic Thomson-Houston Company, of Boston, and so excellent were the lamps placed by it in service, that arrangements were immediately made to control its patents in the District of Columbia, by the not less enterprising United States local corporation.

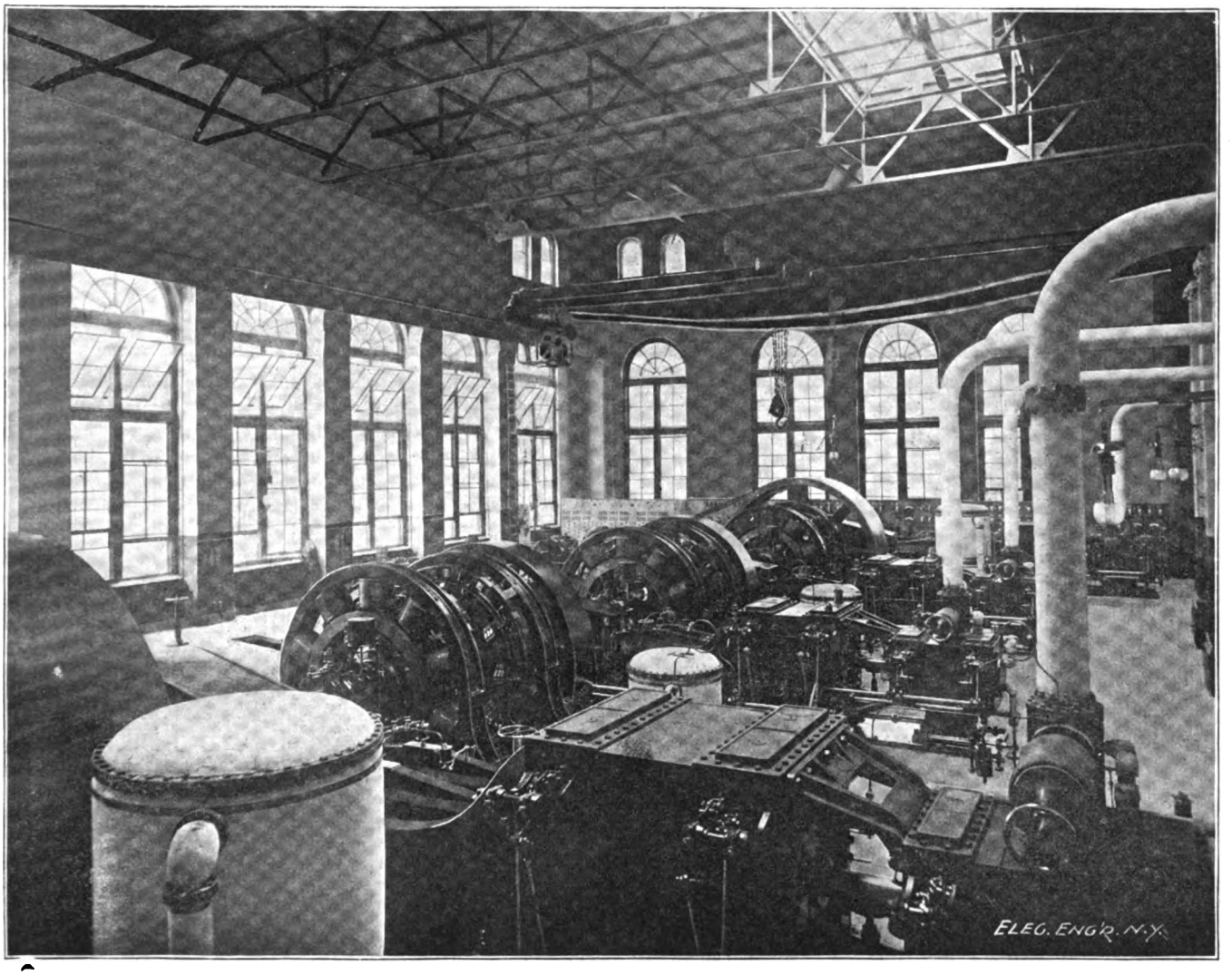
Up to that time the central stations of the company had been in leased buildings, a condition of affairs which manifestly could

Digitized by Google

not long continue; and in the fall of 1886 arrangements were completed to purchase a site 100 by 120 feet, now occupied by a portion of the plant; and the Edison system of central station lighting was decided upon for incandescent work on a larger scale. From this period on, the development of the company has been as rapid as local legislation and conditions would allow, the right to build underground conduits, or any extensions thereof, being only obtained by specific acts of Congress. Additional adjoining properties have been acquired, and at the present writing, the company owns over 55,000 square feet of ground, affording room for any needful expansion, being located as it is, in the heart of the commercial lighting district of the city. With the progressive spirit which has always characterized the management, it was determined, about three years ago, to erect alongside the old plant, the finest modern central station possible to construct, an undertaking seldom feasible for lighting plants where taxpayers have to be reckoned with. The failure thus to keep up to date, in economy and efficiency, has resulted, as is well known, in disaster to many electric lighting companies. The remodeling of the service was placed in the hands of Messrs. Sargent and Lundy, the eminent mechanical and electrical engineers of Chicago, Ill., under the co-operation and supervision of the following building committee: Chairman, President A. A. Thomas, ex-officio, Seymour W. Tulloch, James L. Norris, and John Cammack. The present new station reflects great credit upon them all for the intelligent manner in which the work has been performed. In visiting this beautiful new station as it stands to-day, one gets a vivid, graphic lesson, so to speak, in the evolution of electrical engineering if he first passes through the old station, then into the new, observing the gradual change in the practice of electrical generation.

THE OLD STATION.

The old station, arranged somewhat in the form of a hollow square, contains sixteen boilers of various sizes and makes, twenty-one engines, and thirty-four generators of miscellaneous types, a "happy family" of heterogeneous apparatus and a striking contrast to the symmetry, uniformity, and massiveness of the machinery in the new station. The building is rather low and dark, packed to its full capacity with apparatus, and presenting a weird and interesting spectacle when in full operation. Before taking up the description of the modern equipment, a brief account of the old portion may be of interest, and serve as an interesting object for comparison. There are here installed three 80 h. p. Coleman boilers of the return tube type, five 125 h. p. Harrisburg return tube, two 200 h. p. Campbell & Zell water tubes, and six 375 h. p. National also of the water tube pattern. The engines range from small high speed type, to tandem compound, as follows: Two Westinghouse 15 and 40 h. p. respectively, one 75 h. p. McEwen, six 150 h. p. Armington & Sims, two 125 h. p. Ides, five 125 h. p. New York Safeties, two 200 h. p. simple Green, one 250 h. p. Green tandem compound, and two 500 h. p. Green tandem compound. The small high speed engines each drive a couple of generators by means of belting. The large Green engines have intermediate countershafts. The electrical equipment consists of six 50 light arc machines, of Thomson-Houston manufacture, five 125 light Brush machines, three General Electric alternators of 500, 1,300 and 2,000 light capacity, two 75 kilowatt Edison bipolars,



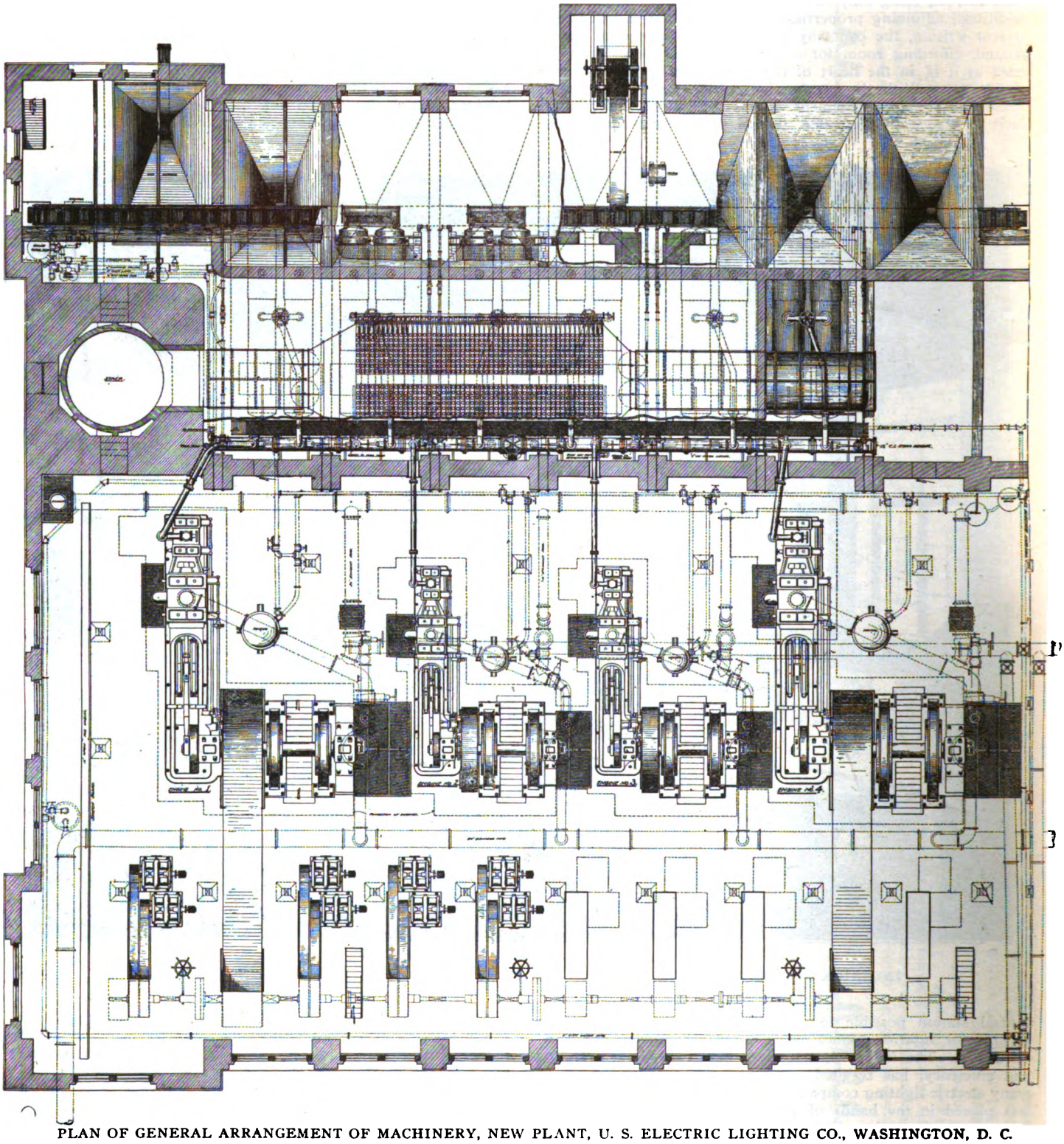
INTERIOR OF NEW POWER HOUSE, U. S. ELECTRIC LIGHTING COMPANY, WASHINGTON, D. C.

Digitized by Google

fourteen 60 kilowatt and four 175 kilowatt also of the Edison bipolar type.

THE NEW STATION.

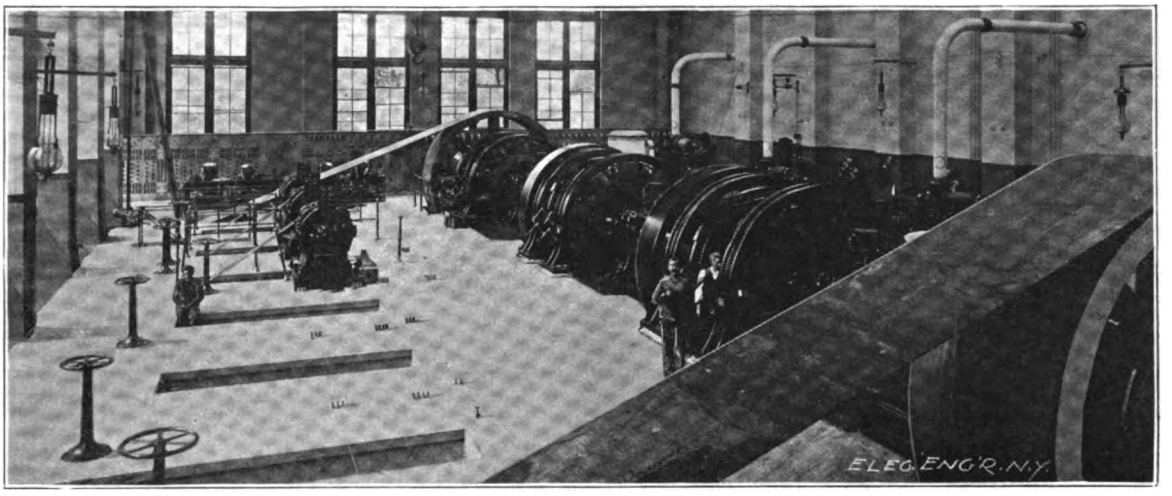
We can now pass down a short lane, and enter the new plant, the building of which is located on the corner of Fourteenth and B streets, extending through to Thirteenth and one-half street. This building is 131 feet long, by 123 feet wide, of brick with steel girder roof trusses, being as near fireproof as possible. The only woodwork to be seen is that entering into the construction of the doors and window framing. The building alone cost $110,000 and was designed by Mr. Erskine M. Sunderland, a conspicuous landmark rising to a total height of 214 feet. contractor for the foundation, which alone cost $25,000, was Mr. Frank L. Hanvey, of Washington, D. C. The foundation consists of 1,300 piles surmounted by solid concrete 36 inches in thickness. The contractor for the superstructure was Mr. Frank N. Carver, also of Washington. The building is about 65 feet high, and is divided into the engine and boiler rooms, with special compartments above as shown by the accompanying plan, and elevational view. Both engine and boiler room are exceptionally cheerful, having generously large windows and skylights. The new structure is overtopped by a steel stack, 142 feet high, mounted on a masonry base of 72 feet, making a conspicuous landmark, rising to a total height of 214 feet.



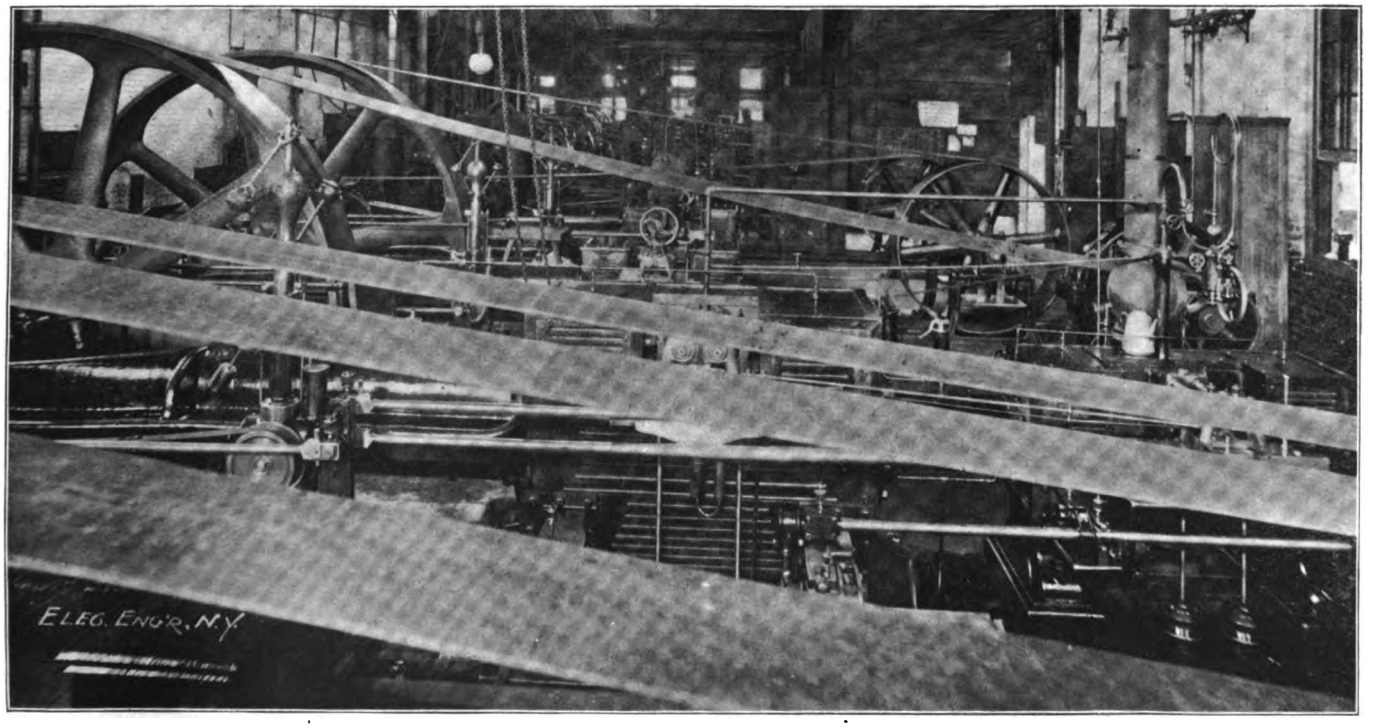
PLAN OF GENERAL ARRANGEMENT OF MACHINERY, NEW PLANT, U. S. ELECTRIC LIGHTING CO., WASHINGTON, D. C.

Digitized by Google

This stack is completely lined with fire brick, and is provided with a steel ladder on the outside. The stack was erected by the Variety Iron Works, of Cleveland, O. The arrangement of the boiler battery is clearly shown in the plan. It consists of six of the new wrought steel water tube boilers, recently placed on the market by the Babcock & Wilcox Company. These are piped in batteries of two each as indicated on the plan. Each boiler has a nominal horse power of 375, and a maximum of 525, with an individual heating surface of 3,021 square feet, summing up a total of 18,126. The working steam pressure is 160 pounds, the battery being equipped with safety valves of Ashton manufacture adjusted to blow off at a pressure of 165 pounds. The pressure is indicated on Ashcroft gauges. The stoking is automatic, and is effected by a link belt grate, of Babcock & Wilcox design, operated by shafting in combination with a small oscillating engine.



THE GROUP OF LARGE NEW BRUSH ARC LIGHTERS.



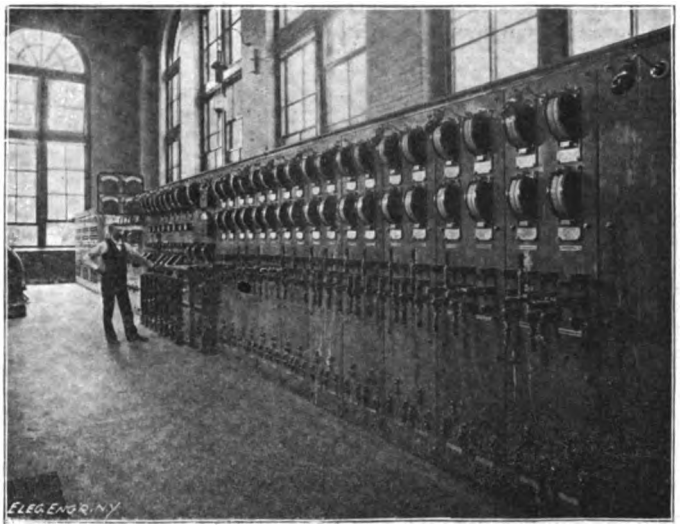
A GLIMPSE OF THE OLD PLANT, U. S. ELECTRIC LIGHTING COMPANY, WASHINGTON, D. C.

STEAM PLANT DETAILS.

The coal is brought from Georgia's Creek mines and is discharged from the outside into a chute leading direct to a crusher, operated by a C. and C. electric motor of 25 h. p. and conveyed by an automatic bucket carrier to the iron coal bins and hoppers over the boilers having a capacity of 1,200 tons. The mechanism and operation of this crusher are made clear by referring to the drawings. The fuel which is now ground to the proper fineness, and discharged into the bins and hoppers, is allowed to fall into a Clark automatic scale, suspended under the delivery pipe, where it is weighed and delivered in 200 pound charges upon pulling a lever, doing away entirely with hand weighing on the barrow. Provision is made for a complete installation of the automatic scales, one to each furnace, making the entire handling of the coal mechanical. The "checking" tests of these scales, by means of a platform standard, have proven very satisfactory. The entire coal and ash handling equipment was furnished and installed by the John A. Mead Co., of New York. The feed water is taken from the city mains, and is bought through a meter at the rate of three cents per thousand gallons. The water is occasionally muddy, but has very slight scale-producing qualities, and gives practically no trouble from this cause. The boiler feed consists of two pumps of the

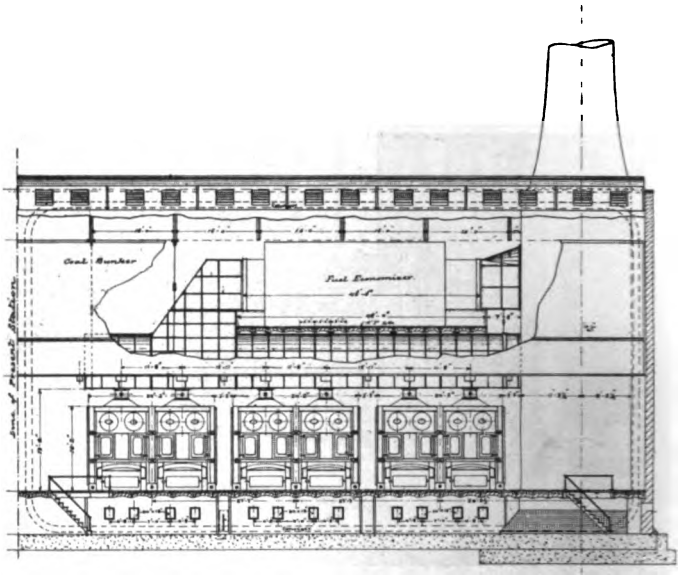
Digitized by Google

Blake Admiralty Duplex type, having steam cylinders ten inches in diameter, 7-inch water pistons, and 12-inch stroke. These pumps, which are located in the boiler room, are bolted direct



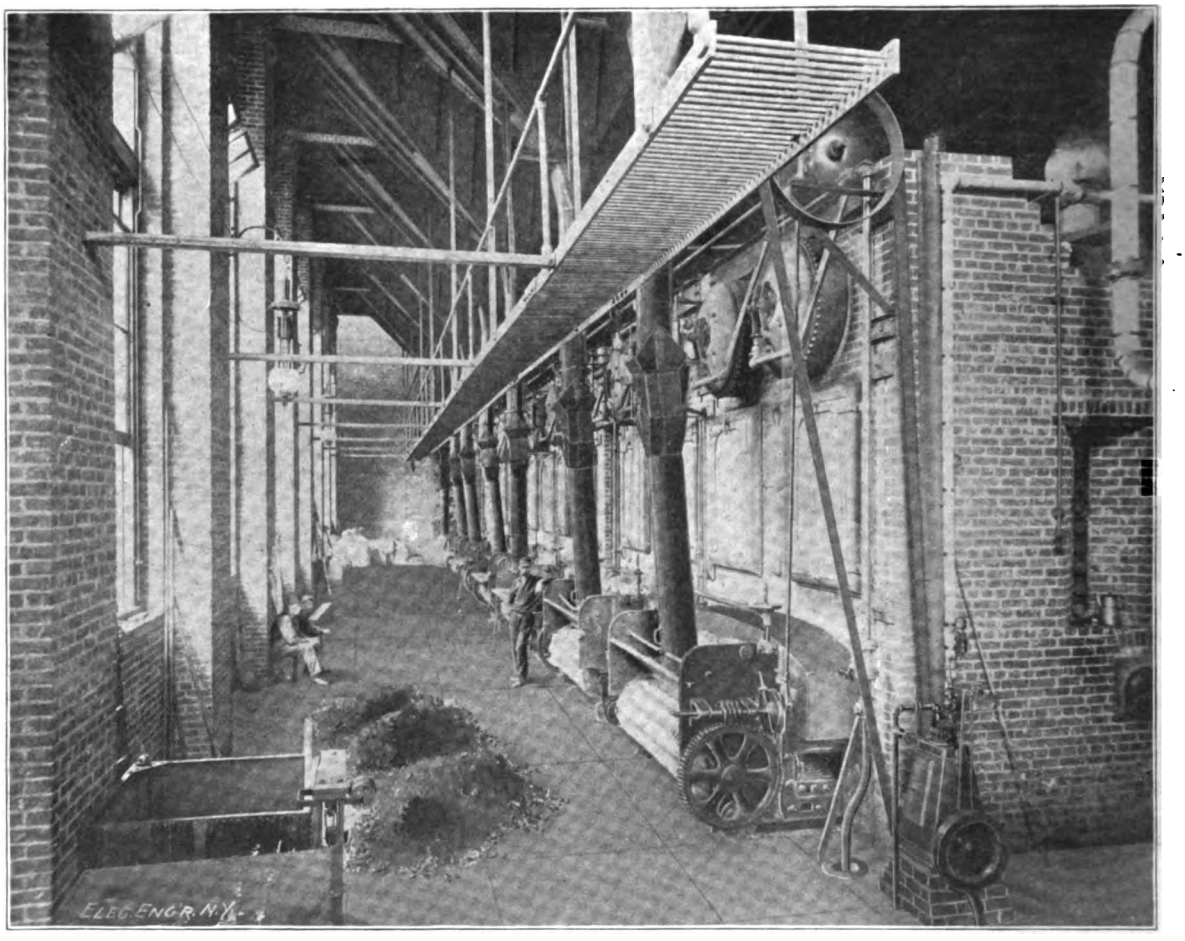
INCANDESCENT LIGHTING END, NEW SWITCHBOARD.

to the masonry base of the steel stack, and are controlled automatically in their operation by Fisher governors. In addition to the feed pumps, the battery is equipped with large Metropolitan injectors. A large Green economizer, manufactured by the Fuel Economizer Co., of Matteawan, N. Y., is installed in a separate compartment above the boilers. The method of suspension and support is made clear by referring to the plan and section of the boiler room. It is interesting to note that this economizer is divided into two sections, each containing 4,992



SECTIONAL VIEW, BOILERS AND GREEN FUEL ECONOMIZER.

square feet of heating surface. The contained scrapers are self-acting, triple bevel edged, and are operated by a C. and C. electric motor of 3 h p. There are in addition to this four feed water heaters, located in the engine room, which were supplied by the Harrisburg Pipe Bending Company. These heaters are all of the copper coil type, two of which contain 300 square feet



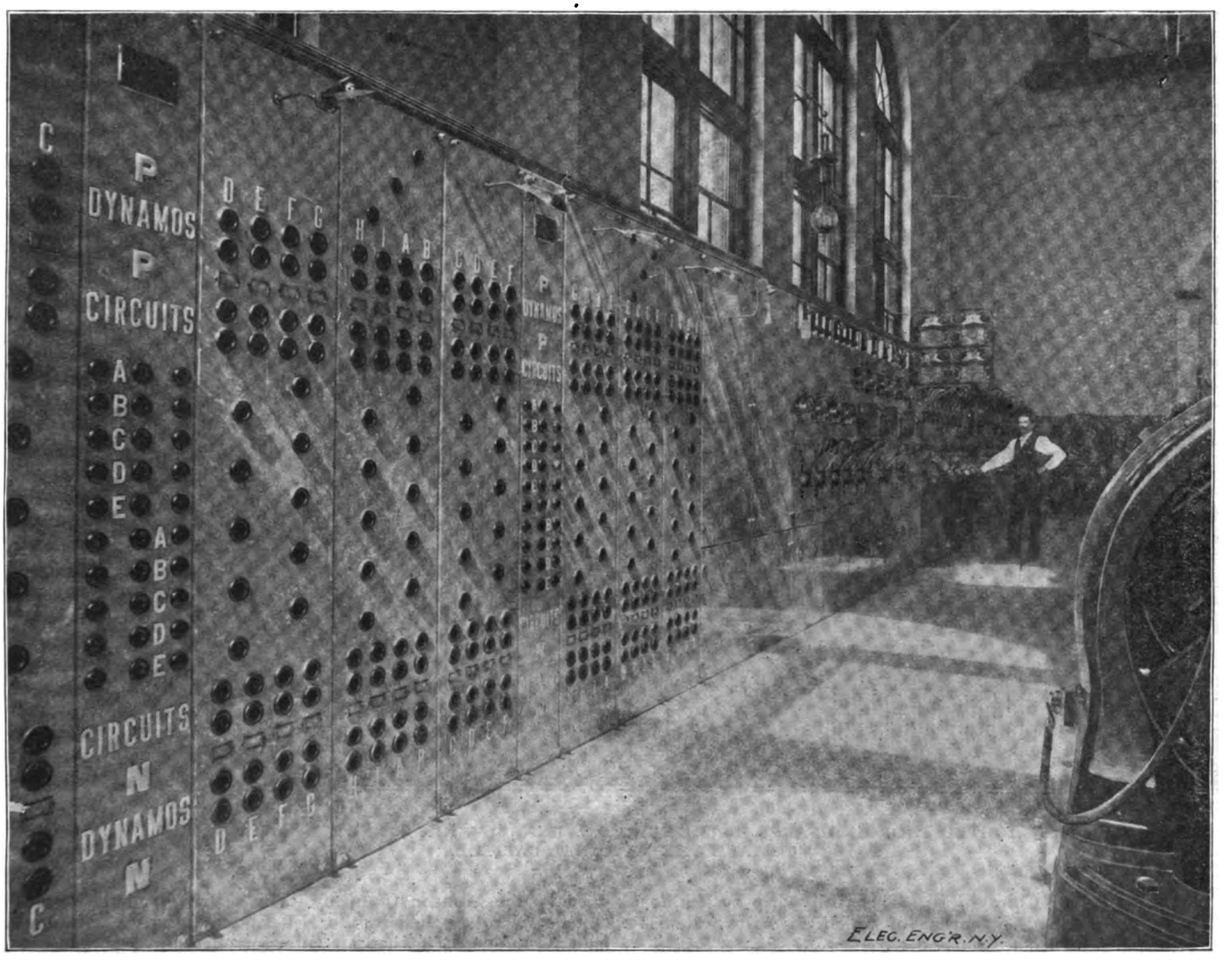
NEW BABCOCK & WILCOX BOILERS, U. S. ELECTRIC LIGHTING COMPANY'S PLANT, WASHINGTON, D. C.

Digitized by Google

of heating surface, and two 600 square feet. There is also included in the equipment one "Webster Special Pattern Heater," which circulates all the water going to the boiler battery, 3,000 pounds passing through each minute. The piping throughout is of wrought iron, of extra heavy weight, the policy of the engineers and of the company being to concentrate on a single system of piping, and having that the strongest and best possible to install, eliminating annoyance, and possible confusion in times of rush, with a duplicate set. This piping is of 6 and 8-inch diameter respectively, for the two sizes of engines which will presently be taken up for description. Large radius wrought iron bends are joined in the piping from boiler to header, and from header to engine, to compensate for longitudinal expansion, as no expansion joints are installed in the station. The piping is fitted with Eddy high pressure valves, having outside screws and yokes, of the by-pass pattern, 8 inches and larger. This piping was all supplied by S. J. McLeod, of Chicago, Ill. The headers are of best cast-iron, in eight foot lengths, one ⅜-inch thick on the run or surface, and one ½-inch thick on the flanges and nozzles. The joints are made without any packing or foreign substance whatever, being ground into contact, as an engine cylinder is ground against its head, and bolted together, insuring the best of joints. This cast-iron header has a diameter of 12 inches, inside measurement, and is divided into two sections by a 12-inch valve. The entire system of piping is covered with magnesium blocks two inches thick, and 85 per cent. magnesium, supplied by Keasbey & Mattison, of Ambler, Pa. This efficient covering taken in combination with the short "runs," less than 30 feet, insures a minimum amount of condensation. A main damper controls the draft from all the furnaces, and is automatically regulated by a Locke controller situated in the engine room. A second automatically controlled damper is situated at the entrance of the stack for operation in connection with the Green economizer. The ashes from the grates of the entire battery are carried by an electrically operated conveyer, and are discharged without handling into an ash bunker, conveniently located for cartage, etc. This conveyor is handled by a 15 h. p. electric motor of the iron-clad type, of C and C manufacture. Each boiler is supplied with a pair of Meyers blowing-off valves, which lead to a main blowing-off header, which in turn discharges into a main blowing-off tank, located near the drain system.

THE ENGINE ROOM.

We can now go into the engine room, or machinery hall, where one is immediately impressed with the beauty of the apparatus, and the thoroughness of construction and finish. Here we have a steel girder roofing about 55 feet above the engines and dynamos, surrounding a large skylight, which in addition to the wide windows which open direct on B. street makes an extremely cheerful hall. The engine room is provided with a 25 ton traveling crane, installed by the Morgan Engineering Company. This crane has a span of 72 feet, measuring from centre to centre of rails, and a maximum lifting capacity of 25 tons, twelve feet per minute. The power is supplied by two General Electric motors of 25 h. p., and 3 h. p. respectively, of railroad type. The entire flooring of the engine room is laid in "Terrazza" mosaic work on a solid cement bed, mounted on short brick arches between the steel supporting beams. Directly around the generating units, the flooring consists of iron plates. The engines are of the well known McIntosh & Seymour manufacture, of tandem compound type, mounted on very



ARC LIGHTING END OF SWITCHBOARD, NEW U. S. ELECTRIC LIGHTING PLANT, WASHINGTON, D. C.

Digitized by Google

heavy masonry, stone-capped foundations. The frames of the engines are of heavy-duty rolling-mill pattern, and present a most massive and substantial appearance. Two of the engines have a capacity of 1,600 h. p., with cylinders 22 and 46 by 42 inches, driving 70,000 pound, 15 foot pulleys, at the rate of 120 revolutions per minute. The engines have complete steam jacketed cylinders, heads and sides and a novel packing sleeve between the high and low pressure cylinders, serving as a guide and support for the piston, and rendering the usual style of packing unnecessary. Superheating receivers are located under the flooring between the high and low pressure cylinders, and have each four coils of copper tubing. The valves of the engines are of the gridiron type, the main valves supporting auxiliary ones which ride on them. The "cut-off" is controlled by governors within the fly wheels, or pulleys, giving very close regulation. Each engine has two exceptionally long bearings on a shaft 19 inches in diameter, completely oil-pocketed, with continuous circulation of oil, due to constantly operated plunger pumps. A complete system of oil drip piping is installed, leading the oil to the basement, a very few feet below, where it is passed through a large Turner filter, furnished by the Economic Machine Works, of Chicago, Ill. The Holly drip system for steam is also installed, by means of which all waste water is collected and returned to the boilers.

Each engine has its independent separator, provided by the builders. The two large engines furnish one indicated horse power per hour on 13½ pounds of steam when running on the dry steam as delivered. The length of the shafts on these engines is 23 feet, with a 19-inch diameter, except where the generator armatures are keyed; here the shaft swells to 22 inches in diameter, nearly two feet. The condensers are located under the outboard bearings. A most interesting feature of all four engines is the direct connected air pumps, which are operated from the ends of the shafts by means of cranks with eight-inch stroke. Approved valves are employed in order to operate or respond quickly to the rather rapid movement of the plunger. This is a novel and decided departure from the usual practice, and has already proven a great success in point of economy. Four oil cabinets are installed, mounting the engine room steam gauges, three in number, one for the working steam pressure, the second for the pressure in the receiver and the third for the indication of vacuum. These were also provided by the McIntosh & Seymour Company. Each of these cabinets is provided with two cocks leading to reservoirs, containing engine and cylinder oil respectively.

The remaining pair of engines are identical in type, but somewhat smaller, having cylinders 16 and 34 by 30. These engines have 25,000 pound, 11-foot fly wheels, and turn over at the rate of 150 revolutions per minute, generating 800 h. p. These smaller engines have an output of one indicated horse power, for one hour, on 14½ pounds of steam. The arrangement of the engines can be seen from the halftone engravings herewith, the two smaller ones being together in the centre, flanked on either side of the larger ones. Each of these large end engines drives in addition to its direct connected generator a portion of the long countershaft in the basement as indicated on the plan, the centre engines of smaller capacity having only their generators to handle. The countershaft is 100 feet long, from centre to centre of outside pulleys, is seven inches in diameter, and is driven by the large engine or engines, as the load may require, at 250 revolutions per minute. This shaft is equipped with friction pulleys and powerful friction clutches for dividing the shaft and two large drums which receive the belts from the end engines. These belts are five feet in width, and were supplied by the Munson Company. The shafting and the friction clutches were supplied by the Hill Clutch Company, of Cleveland, O. These clutches are all controlled by quadrant rack and pinion in combination with hand wheels mounted upon iron stands above. The bearings are liberal and self-centering, the bearing supports being bolted to very heavy stone-capped masonry, entirely in keeping with the substantial construction above. It may be mentioned that this basement is only about 12 feet below the main floor and is almost as light and cheerful as the engine room, being furnished with a row of windows of its own, also opening on B. street. This shafting drives eight Brush arc machines on the floor above by means of eight Schieren perforated belts. Each machine is of the four-circuit type, and 125 light capacity. The machines are belted to turn 500 times per minute, producing at this speed a current of 9.6 amperes, at a potential difference of 6,250 volts. By means of these large multi-circuit machines, the U. S. Company are able to develop their arc lighting business to great advantage over their old underground circuits, with all the economies due to the bigger generating units, in spite of the fact that they were of course unable to put any higher voltage on the underground mains than the familiar 2,000 to 2,500 volts. These large Brush

"ONE OF THE BEST LIGHTED THOROUGHFARES IN THE WORLD," PENNSYLVANIA AVENUE, WASHINGTON, D. C., LOOKING TOWARD THE NATIONAL CAPITOL.

Digitized by Google

machines solved a difficult problem for them in an admirable manner.

We can now return to the large direct-connected units and examine the plan of running. Each engine, carrying as it does a pair of General Electric multipolar dynamos, constitutes a complete Edison three-wire generating unit. Six of these multipolars, have a capacity of 1,500 amperes each, delivering the current at a pressure of 160 volts. Two of these generators, however, have a capacity of 3,000 amperes, at the same pressure, being mounted of course on the shaft of one of the larger engines. The reason for letting the remaining large engine "off easy" with a pair of 1,500 ampere machines, is due to the fact that it is to be made to drive the major portion of the countershaft, and the arc load. This engine can be helped out by the other large engine, and vice versa, by means of the friction clutches, making the shaft continuous. The multipolars are each mounted on the engine shaft between the two bearings, being secured by a pair of large flat keys. The commutators of all these generators are of the double faced pattern, and have the brushes controlled by approved holders. A double pair of brick stairs descend between each set of generators, enabling the attendant to reach with ease all portions of the machines.

ELECTRICAL DETAILS OF NEW PLANT.

A set of General Electric three-wire boosters, are included in the new station, for boosting up the incandescent feed on the longer runs, and for operation in connection with the storage batteries, which will presently be described. The switchboard, shown very faithfully in two of the engravings, is especially beautiful, being no less than 72 feet long, by 8 feet in height, of polished grey marble, mounted in a copper frame, with cornice effect. This board is divided into three sections, the arc division, the alternating incandescent division, and the direct incandescent division. The arc and alternating portions of the board were installed by the General Electric Company, and the direct incandescent, by the General Incandescent Arc Light Company. The alternating portion of the board displaces the board in the old station, and serves to distribute the circuits from the alternators previously described in connection with the old equipment. The direct current incandescent portion of the switchboard is provided with the Van Vleck edgewise system of indicating instruments, saving much space. There are balance indicators, large illuminated dial voltmeters, and recording wattmeters, manufactured by the General Electric Company and the Weston Electrical Instrument Company, mounted upon ornamental brackets and marble shelves.

THE STORAGE BATTERY.

The storage battery is situated in a small building by itself, 18 by 80 feet, and consists of 150 large cells installed by the Electric Storage Battery Company, of Philadelphia. These batteries are connected for three-wire incandescent feeding, and are mounted on porcelain insulators. The charging acid is diluted entirely by condensed steam, from a special piping. This battery is used to help out the generators on an excess load, and was installed at a cost of $50,000. The battery is controlled by a marble switchboard in the engine room, manufactured and installed by the General Incandescent Arc Light Co., the controlling mechanism being operated by small electric motors, located just outside the battery room, and started and stopped by switches in the engine room, about 300 feet distant. The capacity of the battery is 16,000 lamp hours, at an 8 hours' rating. The battery is in two tiers, mounted on leaded steel beams. The flooring is cement, and the ventilation effected by numerous small windows.

THE OUTSIDE DISTRIBUTION OF CURRENT.

The Edison system of three-wire feeding is that solely used up to distances of 6,000 feet. The conduits are terra cotta ducts, "Lynch-Lake" and "Mason." The company has as its territory the entire business section of the city, and the best portion of the outlying districts, and supplies at present the equivalent to 75,000 incandescent lamps of 16 candle power; 700 arc lamps, and 1,200 horse power in motors. The charge for lighting is 15 cents per 1,000 watt hours, with a 10 per cent. discount for payment of bill within ten days after rendition. The charge for power is 13½ cents per 1,000 watt hours, with an ascending scale of discounts, up to 40 per cent., proportional to the amount used. The first installment of lamps is purchased by the user, and replaced free of charge by the company afterward. The arc lamps are supplied to the District and to the National Government for 25 cents per night, and furnished to all other users for 40 cents per night.

One of the engravings that accompany this article shows Pennsylvania avenue as it appears to-day, seventeen years after the first arc lighting was done on that historic thoroughfare. It is now lighted by the U. S. Company with 156 arc lamps suspended from mast arms, furnished by the Russell Co., of Providence, R. I., and placed on both sides of the avenue. There are in addition 20 private arcs in front of theatres, stores, etc., and, of course, when Congress is sitting, and till it rises each night, a strong gleam of white arc light shines down the avenue from the Capitol up on the hill.

The company has in use 2,400 Thomson-Houston meters, of both alternating and direct current type. The territory covered by the alternators and arcs, extends from the Aqueduct Bridge to 11th street, S. E., Water street to boundary, Mount Pleasant to Columbia Heights, to Toll Gate, N. E. The plant is in operation 24 hours, 365 days in the year, and gives the most excellent uninterrupted service. Among the numerous subscribers to light and power may be mentioned the following famous and well known institutions: The United States Treasury, the Bureau of Printing and Engraving, the Corcoran Gallery of Art, the Columbian University and Corcoran Scientific School, the Washington City Post Office, the Washington, Alexandria and Mt. Vernon Railroad, and all the leading clubs, theatres and hotels.

The officers of the company are as follows: A. A. Thomas, President; Seymour W. Tulloch, Secretary; Edwin S. Marlow, Treasurer; James L. Norris, First Vice-President; Dr. Thomas O. Hills, Second Vice-President; Directors, Stilson Hutchins, George W. Gray, Charles C. Duncanson, Clarence F. Norment, Samuel J. Butterfield, William H. Slater and Charles Werner. The superintendent of this engineering work for Messrs. Sargent and Lundy was Mr. C. O. Lenz, to whom much credit is due for the successful carrying out of the plans.

Electric Light Tower Blown Down.

A special dispatch from Danbury, Conn., of Oct. 23 says: "The huge iron electric light tower on White street was blown over by the prevailing storm shortly before noon, but, as it fell away from adjoining property, the wreck of the tower was the principal damage. The structure was 125 feet high, and cost $500. The trimmer had descended but a few moments before the accident."

Shooting the Chute in a Power House.

James Stoddard, a coal passer in the employ of the Staten Island and New Jersey Electric Company, met with a peculiar accident last week at the power house, at Livingston, in which he narrowly escaped being suffocated through his own carelessness. Having nothing to do, he went to the coal bin over the boilers and went to sleep. The coal from the bin is fed to the boilers by a chute. When the firemen required a fresh supply of coal they opened the gates to the chute and the coal began to run down from the bin. Stoddard, who was soundly asleep in the bin, was carried rapidly down through the chute, and awakened to find himself wedged in the neck of the chute and covered with coal. His muffled cries for help were heard by his fellow employees, who were at first unable to locate the direction from which the cries were coming.

They found Stoddard nearly suffocated, and began the work of rescue with the aid of a barrel, which was sent down the chute to keep back the tons of coal in the bin. The men shoveled away the coal that was suffocating the unfortunate man, and at last, with the assistance of a rope Stoddard was released from his perilous position, feeling thoroughly exhausted, but otherwise none the worse for this strange experience.

BOSTON, MASS. Mr. F. A. Gilbert has recently secured for the Boston Electric Light Co., of which he is president, a ten years' contract. It is understood that he will give up the use of open arcs and adopt the enclosed arc entirely.

MR. L. R. CLAUSEN, of Chicago, writes us: "I consider your magazine the foremost among electrical journals in this country and don't feel quite at home without it."

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Beta Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1888.*]

Vol. XXVI. NEW YORK, NOVEMBER 3, 1898. No. 548.

Features of Electrolysis from Railway Work.

INVISIBLE and silent as is the action of electrolysis, it is now so well known and well understood that it faces the electrical engineer as a stern reality and has for a long time received careful study and constant attention. Its causes have been discovered and located, its effects have been carefully observed, several remedies have been applied and numerous investigations made so that the time cannot be far distant when we shall hear little about the destructive effects of stray currents. A paper entitled "An Electrical Survey in the Borough of Manhattan, New York City," read before the A. I. E. E. by A. A. Knudson and abstracted in this issue, has kindled anew public interest in the subject. The vast network of water and gas pipes of New York City, its elevated railroad structure, nay, even the Bridge itself threatened with gradual but certain deterioration and destruction, have naturally given the question of electrolysis a new importance in the daily and technical press. Let us see whether the danger really exists, and, if so, whether it is imminent and incurable. In the first place, let us look for the cause.

On account of their low voltage little damage is done by electric light circuits, so we must naturally look to the electric railway circuit as the offender. Examining, therefore, these circuits, Mr. Knudson finds that an open conduit system, or one in which an insulated metallic return is used, effectually confines the current to the conductors provided for it. This he believed to be preferable to the ordinary ground return, especially in large cities, where the space below the streets is so largely occupied with various lines of iron pipes, more or less subject to electrolytic action. Thus, exonerating the conduit system we are narrowed down to the overhead trolley, the current of which must be kept within bounds. It not alone destroys the system of piping, but has attacked in a most savage manner rails as well as cross-bars and tie-rods, the maximum reading at times being as high as 10 volts, rails positive to the "L" pillars, sewer and gas pipes. Even the Brooklyn Bridge, subject to the abuse of politicians, railway companies and the press, seems now also to be attacked by its own and Brooklyn trolley currents. Quoting Mr. Knudson's own words, as to the elevated road: "In the light of our present knowledge on this subject the very serious question presents itself to any practical mind, in what condition would we expect to find the anchor bolts and iron foundations of these pillars, if excavations were made at their base?" The author, as the title of his paper states, has made a survey of the city giving the leakage p. d. at various locations, which reminds us of the remark of Dr. A. E. Kennelly, made before the Institute in 1894, that, "Though the observed p. d. is an evidence of action, it is not an evidence of quantitative or corresponding intensity of action." Mr. Knudson also refers to several exhaustive tests of Mr. H. P. Brown, made at Dayton, Ohio, which are abstracted on another page of this issue and which also show the destructive action of stray trolley currents. It is encouraging to note that both Messrs. Knudson and Brown advocate joint action on the part of all companies concerned and suggest as the only certain remedies large railway returns and thorough rail bonding. They also heartily indorse the remarks of Mr. Farnham several years ago that "Eternal vigilance will be the price of pipes and cables where conditions favorable to electrolysis exist." Besides this caution, however, many remedies have been suggested in addition to those mentioned above, several of which have already been abandoned. Among these should be mentioned (1) the connecting of cables to ground plates, which Mr. Farnham found of no material advantage; (2) the employment of motor generators, which generate a secondary current to be utilized to lower the potential in the cables and pipes to zero, with respect to the surrounding earth or rails; (3) to protect water and gas pipes by a sufficient insulating jacket; (4) to reverse the railway current at frequent intervals, which was found to be impracticable during regular traffic and only effected a change of location of the danger area; (5) covering the cables with tar, and many others. As practicable, on the other hand, the following remedies are advocated in addition to the two mentioned above: (1) No more lead or wrought iron pipes should be put down than is absolutely necessary; (2) wooden pipes are preferable or interposed sections of wooden pipes—in other words, breaking the metallic continuity of the pipes; (3) painting the lead caulking of cast iron mains; (4) connecting the positive pole of the dynamo to the trolley wire, and others, all of which have been discussed at length in the papers of Messrs. Farnham, Knudson and Brown. Frequent inspection and measurements, as well as legislative action, are advocated by every authority, similar to the regulations established by the British Board of Trade. It should be borne in mind, however, that our own national electrical code contains the following section: "For the diminution of electrolytic corrosion of underground metal work, ground return wires must be so arranged that the d. of p. between the grounded dynamo terminal and any point on the return circuit will not exceed 25 volts. The positive pole of the dynamo to be connected to the trolley line." This action, together with a knowledge of the causes and effects of electrolysis, as well as the use of proper remedies, frequent tests, conservative action, and the fact that the conduit trolley system is quickly supplanting the single overhead trolley in large cities, will soon relegate the question of electrolysis to its proper place among the passing evils found in early electrical engineering.

Legitimate Ways of Getting Cheaper City Light.

A STRIKING narrative is given in our columns this week in regard to the gas situation in Vienna and the palpable discomfiture there of the Anti-Semitic Burgomaster Lueger in his effort to wreck the English gas lighting corporation that had been supplying the city and that had offered to make many concessions to secure decent treatment. The item does not tell all the facts, however, for it is understood that in borrowing the money for his own wild-cat "municipal" scheme, Herr Lueger gave away some very profitable street railway privileges, which on his own platform should have been worth large sums to the city. The horrible collapse of his campaign adds another chapter to the record in which the Philadelphia gas plant figures so prominently.

A week or two ago Mayor Flower, of New Orleans, addressed the Press Club of that city on "Municipal Problems Confronting the City," and in the course of his weighty remarks he touched on the lighting question. New Orleans has not escaped the "municipal plant fever," but he pointed out how sadly the city lacked in other directions where it had prior needs and duties that must be met, and for which no private institutions existed. For instance, out of 700 miles of streets in the city, only 195 miles were paved, and some of this was paved with little better than good intentions. He mentioned other things, and then said: "We are at this moment much concerned with the problem of lighting. Our present contract has four years more to run. We are paying at the rate of $127.50 per light, and we have now burning an excess of 147 lights over our contract and appropriation. To suspend these will throw certain sections of our city in darkness. The holders of the present contract have approached the city government with a proposition that in consideration of a renewal of their contract for a term of years, they will so reduce the present cost per lamp as to liquidate the indebtedness of

Digitized by Google

some $50,000 odd, due them by the city, for excess of lamps, and guarantee a continuance of the present installation. Want of funds, as I have so fully explained, forces the city either to continue a debt for extra lamps without provision to pay, or to discontinue them, and throw the city into darkness in many important sections, or to extend the contract under the above conditions."

Obviously an extension of contract, safeguarding the city's interests, is the wise and only course, and Mayor Flower showed that Boston, confronted with similar conditions, had extended her lighting contract for ten years and made a good bargain. On the other hand, the local companies, by the greater permanence given to their business and prospects, can go on making improvements and can afford to make much lower prices.

The Garb of the Telephone Girl.

WHERE employees of any service come into relation or contact with the public, it is certainly desirable for many reasons that they should be uniformed. In fact, it is hard to understand how large bodies of employees can be distinguished from the public in any other way. But the case seems a little different where the employee works under conditions of retirement from the public eye, and hence we do not wonder at the reports of discontent among the telephone girls of Vienna. A new regulation of the authorities provides that all employees, as soon as they arrive at the office, shall remove their street dresses and put on uniforms furnished by the Government. In addition to this, the girls are compelled to take off their shoes and substitute slippers for them. The threatened strike is due to what they call the lack of taste of the man who selected the material and fashion of the dress. It is made of cheap stuff, similar to that used for dust cloaks, and is dark in color, while the narrow sleeves are made ugly by yellow stripes in imitation of the national colors. The officials say that the new order was necessary, as the dust clinging to the dresses of the telephone girls when they arrive at work finds its way into the instruments and brings about a disturbance in the service.

We must say that this regulation strikes us as unduly hard, especially when one remembers the brightness of dress of the average Vienna lass. But the desire for cleanly switchboards is also pushed too far, for an edict preventing the use of any fluffy dress material would accomplish the end aimed at.

In one of the largest Western telephone exchanges considerable trouble was once caused by a move of this kind. There, if we remember aright, every one of the girls was dressed in black, and even the headbands were black, while no bright flower or ribbon in the hair was allowed. The aim was uniformity and a diminution of dust, but the thing was overdone; and we believe the rule has not been persisted in. A visitor to the exchange last summer tells us that while the girls were all in black skirts, they wore any kind of a light and bright "shirt waist" that pleased them, and the room looked all the better. We undertake to say that the work did not suffer a whit.

Insulating the Mind.

THERE is a story told of a traveler in the tropical forest who, thinking to drink water from some tree or vine, tapped instead, unwittingly, a rubber bearing plant. Mixing a little rum with the liquid he quenched his thirst only to die a few hours later with rubber bands clogging every turn of his intestines. The insulated victim of this traveler's tale finds his counterpart in actual life in a New Jerseyman, who went around lately with a bottle of rubber pellets, which he ate to prevent another man from hypnotizing him with electricity. His idea was, he said, that he would thus "insulate his mind" successfully, just as the tropical tourist quenched thirst; but such experiments prove disastrous and have to be stopped, whether the victim takes his rubber solid or fluid.

This Jersey incident shows how recondite phenomena catch the public imagination, and how curiously wrong the popular impression or information is. A Western statesman objected once to the "magnetism" of the late Mr. Blaine on the ground that "it had to be taken hot or else it soured on the stomach." Just what that statesman imagined "magnetism" to be is not clear, but it would seem that he had contrived pretty well to "insulate his mind," not only against it, but against accurate knowledge on the subject. He might have been a Chinaman or a Spaniard or any other dignified conservative, preferring insulation to conductivity or receptivity.

OBITUARY

Camille A. Faure.

THE death of Camille A. Faure again reminds us of the fact that the pioneers in the electrical field are being rapidly taken from among us, leaving behind them a heritage which we, the younger generation, are exploiting and reaping therefrom a profitable harvest. The recent developments in storage batteries and their extensive introduction have made us more and more indebted to those two great French pioneers in that field, Planté and Faure; the former for his historical researches in 1859 and succeeding years, the latter for devising, in 1881, a method of pasting the lead oxide or active material directly upon the plates.

Camille A. Faure was born May 21, 1840, at Vizille, in the mountains of Dauphiné, and although he received some instruction at a professional school, he must be considered as self-taught. From 1859 to 1872 he found successive and uninterrupted employment as mechanical draftsman, or in superintending the erection of metal works at sixteen different establishments in France and England. In 1859 he invented the "Black Bottle" nitric acid battery, manufactured by Elliott Bros. In 1872 there is a record of his attempt at obtaining a secondary battery. The development of M. Faure is due greatly to his quiet and long stay with a cotton powder company, whose works he erected for the manufacture of the explosive "tonite." This is his invention, together with the distress signals almost exclusively used by the Board of Trade in England, as well as the Mercantile Navy. In 1878 he returned from a visit to the Paris Exhibition, with the idea of his secondary battery well fixed in his mind, and within a month he had discovered spongy metallic lead obtained from insoluble oxide, and perceived its value as a material for negative plates. He afterwards made a secondary battery out of elments made entirely of sulphate of lead. This battery completed, M. Faure, as a true inventor in spirit, and in ignorance of business, ran immediately into new thoughts, leaving to others the commercial development of his invention. However, in 1882 he improved his battery by perforating the plates and alloying the lead of the supports with antimony. Besides these and other improvements in storage batteries, M. Faure has done remarkable work in various directions, particularly in his attempts to utilize electricity in the manufacture of aluminum. The practical way of utilizing chloride of sodium occupied his mind since 1872. A petroleum motor of his, which possesses novel features, is also on the market. His scientific contributions can be found in large numbers in the annals and proceedings of several scientific societies.

In the death of M. Faure, France loses one of her most distinguished inventors and scientists, and the world one of its greatest benefactors.

C. G. Davenport.

A dispatch from Waterbury, Conn., of Oct. 26 says: "Word was received here to-night of the death in Puerto Rico of Clarence G. Davenport, son of the Rev. J. G. Davenport, and Corporal in Company F, First United States Volunteer Engineers. Death was due to typhoid fever. The deceased had been employed for several years by the General Electric Company as an electrical expert. He was an associate member of the A. I. E. E."

BICYCLE PEACE PARADE. In the night parade up Fifth avenue, New York City, on Oct. 31, the Electric Vehicle Company had five illuminated hansoms, etc., in line, and Mr. A. L. Riker had four of his electric carriages. The effect was very fine and made a most favorable impression.

WEST DULUTH, MINN., pronounces an utter failure the naphtha street lamps that have been substituted for electric lights. This might have been expected.

BOSTON has been talking with Kansas City over the long distance Bell telephone wires. The distance is about 1,560 miles, and the talking was excellent.

Digitized by Google

TWENTIETH TRIENNIAL EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, BOSTON, OCTOBER 10 TO DECEMBER 3. 1898.—II.

The Exhibit of the Edison Electric Illuminating Company of Boston.

THE Edison exhibit has the place of honor in the grand hall. It consists of two sections, flanking the main aisle. Over this aisle has been placed a canopy, so that the two sections are, in reality, combined into one grand structure. This booth, designed by Winslow & Wetherell, architects, is a correct representation of an old vine-clad Roman pergola. It is entirely covered with tropical smilax, brought from Alabama especially for this purpose. Peeping out from among its green leaves are nearly 4,000 miniature incandescent lamps; some of these arranged to spell out the title of the company, and various mottoes applicable to the Edison Company. Others are arranged in designs in keeping with the booth and its surroundings.

In the lighting section are shown not only the various kinds and sizes of arc and incandescent lamps used by the Edison company, but the methods employed in measuring the candle power and the electricity consumed. A number of Jandus enclosed arc lamps are shown, each of which is made in a finish intended to show the various kinds of lamps which can be supplied to meet special requirements. General Electric enclosed arc lamps are also shown in different finish, available for different uses. Ziegler enclosed arc lamps are also on exhibition, as well as the Ziegler stage projector. This lamp is to take the place of the clumsy and rather troublesome calcium-light outfits which have been used in our theatres in past years.

As the arc of an arc lamp is extremely bright and trying to the eyes, there has been devised an arrangement by which the arc, somewhat magnified, is shown by means of a lens upon a piece of paper. This can be watched by a number of people at the same time without in the slightest disturbing the light. An inspection of this reproduction shows the arc jumping from one carbon to the other and the gradual wearing away of the carbons. It is one of the most interesting details of the exhibit.

Upon a marble slab are mounted all the various sizes of lamps used by the Edison company, both in plain and frosted glass. These can be turned on and off at will by visitors.

Mounted upon a pedestal near one of the entrances is a meter capable of carrying 16,000 lamps. Near it is one of the other extreme, suitable for operating ten lamps. Both of these meters are in operation, and covers have been removed so that visitors can see the internal working of the meters.

For the first time in the history of electrical exhibits, a prepayment type of meter is shown and in actual operation. The device was designed by the General Electric Co. to be attached to one of their standard meters. The special form shown in this exhibit is equipped with a slot capable of receiving a ten-cent piece. The meter can be "loaded" with twenty of these at one time, so that $2 worth of electricity can be obtained without further attention. When the amount of electricity called for by the amount of money deposited is used up, the lights are automatically cut out, and they cannot again be turned on until another ten-cent piece is dropped in the slot.

A Wright demand indicator is also shown. This is based upon the principle of a recording thermometer. The electricity, passing through a coil, heats up a bulb filled with a solution of acid. This acid is pushed over a precipice and falls into another tube, where the height is recorded by means of a scale, graded in proportion to the amount of electricity passing through the coil. After a reading is made, the thermometer is turned upside down and the acid runs back into its original receptacle.

There is also exhibited a two-rate meter, manufactured by the General Electric Company, and intended to be used where it is desirable to charge different rates for electricity at different times during the day. It is equipped with two dials, which are thrown in or out of use by an electric clock.

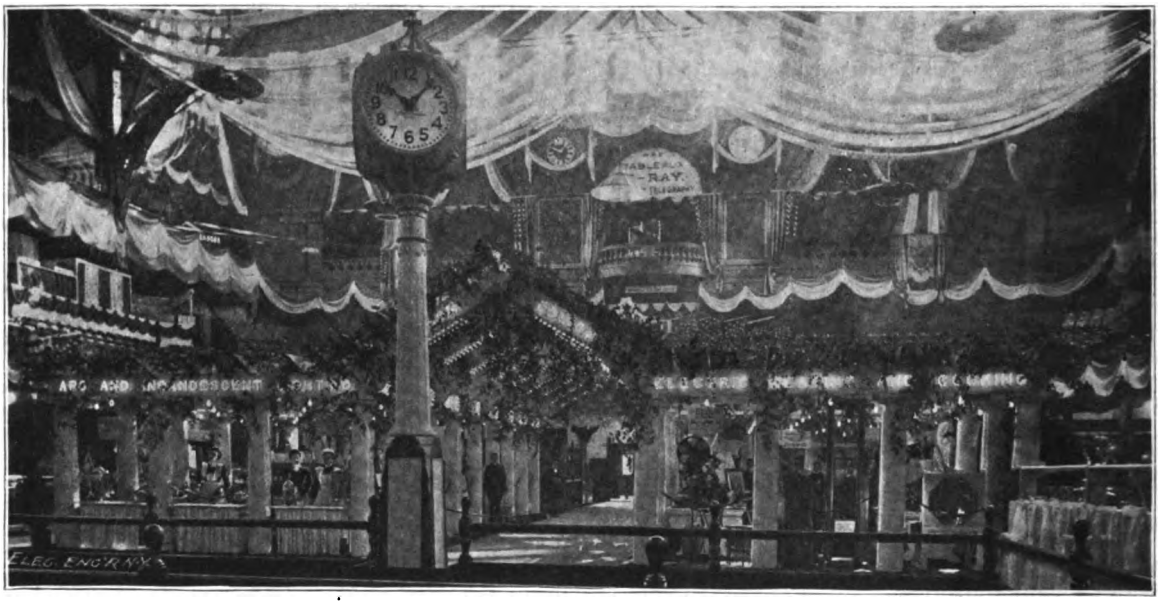


EXHIBIT OF THE EDISON ELECTRIC ILLUMINATING CO., OF BOSTON, AT THE MECHANICS' FAIR.

In the power section are shown a number of the newer applications of electricity to domestic and mechanical uses. The Golding printing press shown is equipped with a General Electric motor. This motor operates the printing press by a friction wheel, thus doing away with cog-wheels, belts, and other objectionable features. There are further shown: A Singer sewing machine, operated by a Diehl motor, mounted directly on the spindle. The speed of this machine is varied by the foot treadle. A Ziegler motor generator. The motor is operated by the Edison current, and drives the dynamo, which generates current of any required voltage or amperage. The Edison current is thus turned into electricity suitable for telegraph instruments, surgical apparatus, or other appliances of various characters. In this exhibit it is used to operate an induction coil which gives a spark of intensely high voltage. The Elektron automatic dumb waiter, an ingenious apparatus to be used in all places where dumb waiters are desirable. Upon each floor landing are located three buttons: one to make the car go up, another to make it go down, and the third to stop it. It is entirely automatic in its operation, stopping the car at the top and bottom without any attention. A Davidson fan wheel, which is a ventilating fan operated by an electric motor, connected directly to the end of the shaft. A Worthington pumping plant operated by a General

Digitized by Google

Electric motor. This apparatus shows in rather a startling way the adaptability of electricity to any part of one's premises for any kind of use. Blow Hot—Blow Cold, which is an ordinary fan motor, manufactured by the Bay State Motor Company, with an arrangement in front of the blades of the fan which can be heated up by means of the electric current. Either hot or cold air can be furnished by this arrangement. Burton electric forge, to be used in place of the ordinary blacksmith's forge. The tank is filled with a saline solution. All that it is necessary to do is to rest the bar of iron to be heated upon the iron arm of the forge, and allow the end to come into contact with the solution. It is immediately heated red hot. When it is desired to cool the iron, it is only necessary to raise it off of the arm, when the same solution which heated it will now, in turn, cool it. Stowe flexible shaft, driven by a New England motor. This shaft may be used for any apparatus transmitting or receiving power, and may be bent at any angle without loss of efficiency. Its convenience in places difficult to reach is clearly apparant. Sprague automatic electric house elevator. This elevator is run without an attendant. When a button is pushed upon any floor landing, the car immediately comes to that floor and opens its door automatically. Whenever the door is open the car cannot be operated or disturbed from any other floor. As soon as the passenger enters the car and closes the door, he obtains complete control of the apparatus, and it cannot then be operated from any point outside the car. It is, of course, especially adapted to house use, but can be used in places where, for other reasons, it is desirable to have an attendant. All of the apparatus shown in the power section is in actual operation, and is explained by the attendants in charge.

In the heating section are shown heating and cooking utensils. They are all manufactured by the American Electric Heating Corporation. All of this apparatus is in actual operation. Tea, bouillon, chocolate, and other warm drinks are being served, free of charge, at various times during the day and evening. Light cooking is also going on at most times. By an arrangement with the restaurant upstairs, heavy cooking, such as chickens, roasts, etc., is carried on by the attendants. This interesting feature is attended to by the following very able cooks: Mrs. A. B. Eastman and Misses Alice Prescott and Blanche Shortwell.

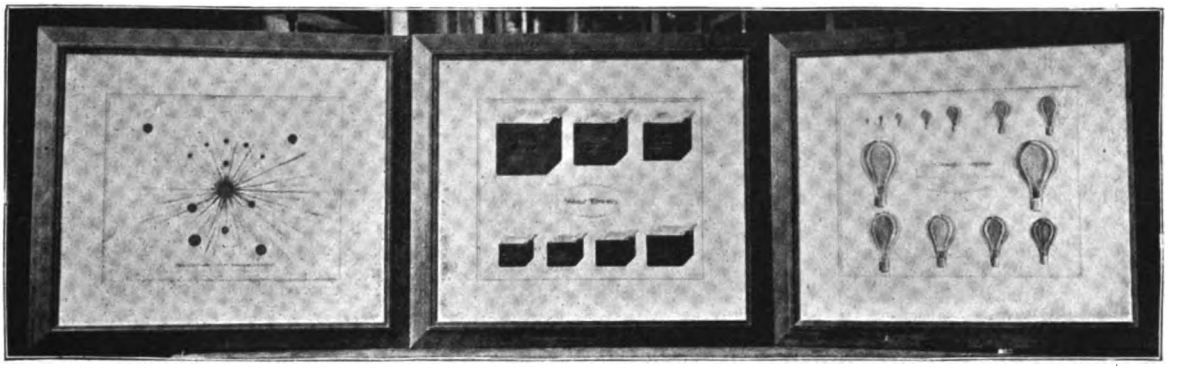
There is also shown what has been termed an "electric hydrant," which has recently been introduced by the Edison company. It is intended to locate these hydrants at various points throughout the city. They are to be equipped with a prepayment or nickel-in-the-slot meter, and keys for opening these boxes will be given to all owners of electric wagons. When the driver of one of these wagons finds that his electricity is about used up, it will simply be necessary to stop by the side of one of these hydrants, open the door, pull out a flexible cable, and connect it to the bottom of his wagon. He will then drop the necessary "nickels" in the slot, depending upon how much electricity he needs, and wait for his battery to be recharged.

In the miscellaneous department are also shown a "Chloride" accumulator; an underground junction box, with the Edison tubes running into it from various points: electric fans, etc.

Various pictures showing all the more recent exhibitions in which electricity has played a prominent part are located in various parts of the exhibit. The diagram located at the right of the entrance is of special interest. It is called the "Hub of the Solar System," and shows in a diagrammatic way the number of electric lamps in Boston per one thousand inhabitants as compared with other leading cities of the world. Bostonians have a right to be proud of this showing, as their city leads all other cities by over 50 per cent., as shown by the following figures: Boston 1,232, New York 859, Chicago 730, San Francisco 660, St. Louis 660, Cincinnati 551, Philadelphia 375, Baltimore 373, Brooklyn 286, Vienna 246, Edinburgh 242, Paris 185, London 184, Berlin 178. These figures may be split up into lamps supplied by central stations and those by isolated plants, and we find that Boston has 396 isolated and 836 central station lamps per 1,000 inhabitants, New York 370 isolated and 489 central station, and Chicago 436 isolated and 294 central station. This chart is shown in the illustration, as is also the one showing the relative capacity of the storage batteries of the various large central stations in the world. The other chart shows the growth of incandescent lighting in Boston for the thirteen years from 1886-1898, being the number of lamps connected. These were 4,847 in 1886 and 166,376 in 1898.

The Moore parlor, located in the basement, is supplied with electricity from the Edison system. In a special section is located a working model showing, even to the casual observer, the whole theory upon which the Edison system is operated. People have often been told that if they used the Edison system it was necessary to have only one service installed in their premises. This is brought home to every one very clearly by an actual demonstration. Two posts have been erected upon a table, each carrying a wire, one positive and the other negative. From these wires are suspended, in actual operation, an arc lamp, a couple of incandescent lamps, an electric fan, and an electric teakettle. It tells its own story and needs no explanation. In front of it stands a bust of Mr. Edison. The entire lighting of the Edison booth is taken from the underground wires of the Edison system and is entirely independent of the isolated plant in the Mechanics' Building. The Boston Edison Company has placed its stations at the disposal of the Mechanics' Fair, and a heavy line has been run from the switchboard in the basement to the Edison underground system. Exhibitors are therefore not only able to get electricity from the plant at the Fair Building, but they can also feel that extra reliability is assured by this supplementary connection.

This splendid exhibit is in charge of Mr. La Rue Vredenburgh and a corps of assistants. Much credit is due also to Mr. C. L. Edgar, the general manager of the company, who lent his valuable aid, influence and advice in making this exhibit such a grand success. A special Edison folder has been prepared by Mr. Vredenburgh, and is distributed at the booth, together with other valuable and interesting literature.



CHARTS EXHIBITED BY THE EDISON ELECTRIC ILLUMINATING CO., OF BOSTON, AT THE MECHANICS' FAIR.

Hamilton Gas Engine and Keystone Dynamo Exhibits.

Geo. Tyler & Co., of Boston, are exhibiting in the basement of the grand hall of the Mechanics' Fair, a Keystone lighting dynamo in connection with a Hamilton gas engine, for which they are the Eastern agents. The gas engine they state is of exceptional merit and usefulness for isolated electric light plants, and has been inspected by a large number of visitors. They claim to furnish the gas engine in connection with an electric light plant at a cost of between one and two cents for every

Digitized by Google

ten lights of 16 candle power per hour. The engines are instantly started and require no experienced engineer to run them. The gas engine is running also a 3 horse power Keystone motor which is propelling various styles of pumps for water supply, showing in all what can be accomplished with the Hamilton gas engine for use in an isolated plant. The Hamilton gas engine is manufactured by the Advance Mfg. Co., of Hamilton, Ohio.

The Moore Vacuum Tube Parlor at the Mechanics' Fair.

JUST as the vacuum tube lighted booth at the New York Electrical Show in Grand Central Palace in May, 1896, the vacuum tube system of illumination in the Moore Chapel at the Electrical Show in Madison Square Garden last May, and Turkish smoking room at the Philadelphia Electrical Exhibition last

MOORE VACUUM TUBE LIGHTED PARLOR AT THE MECHANICS' FAIR, BOSTON.—PHOTOGRAPHED BY ITS OWN LIGHT.

June, proved to be great centres of interest, so the latest and most up-to-date departure in vacuum tube installations—the Moore Parlor—has become one of the most popular and crowded exhibits at the Massachusetts Charitable Mechanics' Fair in Boston. The "Moore artificially daylighted parlor," as it is popularly called, commands the attention of the public in a way that none of these previous vacuum tube exhibits did, for the reason that this illustration of its domestic application seems to point to the fact that the time is not far distant now when vacuum tubes will be in as general use as the arc and incandescent lamps are at present.

Though the parlor is not located in the most conspicuous place, it is continually filled with people, all admiring the soft white light from the clear glass tubes, for it is Boston's first opportunity to become acquainted with "The Light of the Future." Long before the time of opening the doors of the passage leading to the parlor, the crowd begins to collect and several guards are necessary to keep the throng in line.

The first introduction the visitor has on opening the doors is to a dark passageway. As he turns an angle at the far end, the soft light from the vacuum tube letters "M. C. M. A." encourages him to continue his pilgrimage. At the same time the murmur of voices, above which are heard the notes of the piano, assures him that he is presently to reach the object of his search. A moment later on making another turn there is brought into full view the pretty vacuum tube lighted parlor. The accompanying illustration from a photograph taken with no other light than that emitted by the tubes, shows with what care and taste the parlor has been arranged. The waxed parquet floor, the rich tapestry, the gilded festoon around the frieze and the glowing log in the fireplace help to make up a charming scene. But the tubes arranged just above the moulding and encircling the room, together with a neat design of ceiling fixture surrounded with curved tubes are the features of interest, as well as of beauty, in the parlor.

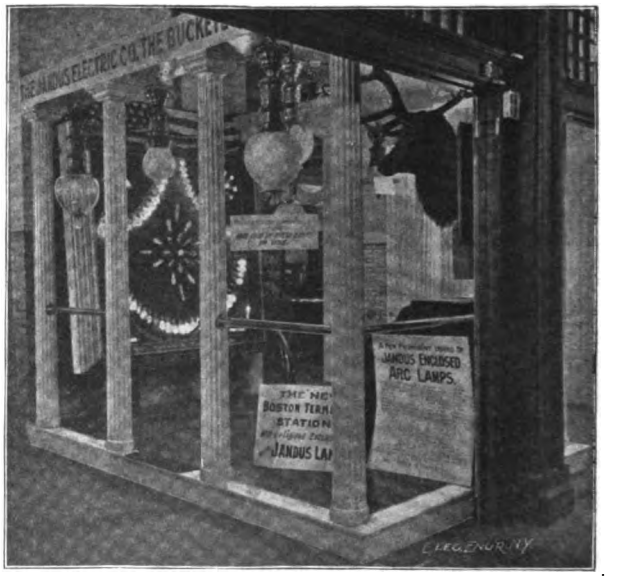
The quality and quantity of light emanating from the tubes is such that the colors of the water color pictures on the wall are as true and pure as in daylight.

The method and design of the wall and ceiling fixtures are entirely new, as this is the first parlor ever lighted with vacuum tubes. The current used for the light is taken direct from the street mains of the Edison Electric Illuminating Co., of Boston, and the apparatus for producing the light is all contained in an oak cabinet 4x2x2 feet.

As this parlor is the first practical demonstration of how the new system of lighting will be applied in the home it has aroused considerable comment, and it constitutes one of the most striking and memorable features of a very fine exhibition.

Joint Exhibit of the Jandus Electric Co. and Buckeye Electric Co. of Cleveland, Ohio.

THE exhibits of the Jandus Electric Company and the Buckeye Electric Company, both of Cleveland, have been combined in one place and are located under the gallery in the main hall. The style of architecture employed is on Grecian lines and offers an excellent opportunity to display the enclosed arc lamps and incandescent lamps made by these two companies. Between each two pillars is hung a different type of Jandus arc lamp; in all nine lamps are shown. There are three kinds of standard lamps representing their indoor and outdoor type and a silvered one with elaborate ornamentation hung in the centre of the booth. There are three types of their short or 25-inch lamp, one having a globe and one having a shade; the other lamp of this type being a three ampere lamp with a small globe and representing their "Junior" type. There is also shown one of their 220-volt enclosed arc lamps and their alternating enclosed arc lamps. The case of one of their standard lamps has been entirely removed in order to show the working mechanism of the lamp. It may be of interest to state that the Jandus Electric Company began the manufacture of enclosed arc lamps about five years ago. It was originally put on the market as "Manhattan," and obtained a wide reputation under that name; it is now known as the "Jandus" lamp. The original mechanism in this lamp is the same as that used to-day, with improvements in detail. The lamp is made for all kinds of electric circuits—direct and alternating—series work, railway work, and 220 volts. Lamps are made for any amperes from two and one-half to six, and in different sizes, large and small; in fact, the Jandus



JOINT EXHIBIT OF THE BUCKEYE AND JANDUS ELECTRIC CO.'S MECHANICS' FAIR, BOSTON.

Company is prepared to furnish any kind of an enclosed arc lamp desired.

The Buckeye exhibit consists of a very handsome and elaborate lamp bank. These lamps are mounted on a background of black felt set in a very handsome gilt frame and the whole arrangement is suspended on an easel. The lamps are very artistically arranged and there is shown one type of each lamp made by the Buckeye Company. In addition to the various types

Digitized by Google

shown there are lamps of different colors, arranged in one complete half circle.

The Buckeye Electric Company are one of the oldest of incandescent lamp manufacturers. They claim to be the first company to discard ancient methods and adopt the cellulose filament, with the result that all other companies are to-day following in this direction. Their product consists of all kinds of standard incandescent lamps for all voltages. The 220-volt lamp made by the company has found great favor in 220-volt installations, and the demands for it are constantly increasing. Many of the largest electric railroads in the country have adopted this lamp as their standard. Within the last twelve months their sales in New York and New England have increased over 500 per cent. The New York office of the two companies is 11 Broadway, and the Boston office 524 Tremont Building.

Electric Light and Power Exhibit of James L. Russell.

MR. JAS. L. RUSSELL, of 170 Summer street, Boston, whose exhibit we show herewith, has just completed his first year in business for himself. Previous to this branching out he was connected with the General Electric Co., the Mather Electric Co., and several others. He has a large acquaintance throughout the New England States in the trade. His exhibit of the new Nowotny enclosed incandescent arc lamps is every interesting. He has several of them burning constantly. The principal advantages claimed for them are as follows: Freedom

EXHIBIT OF JAMES L. RUSSELL AT THE MECHANICS' FAIR, BOSTON.

from shadows, simplicity of working parts, convenient to trim, no inner globe breakage, will burn 150 hours with one trimming.

He also exhibits one of the Onondaga Dynamo Co.'s machines, for which he is New England agent. The motor is in constant operation, and is pronounced by those who have given it a thorough examination, to be a very smoothly running mechanism. Their new brush holder is very neat and simple. Mounted on a marble switchboard manufactured by the Shawmut Fuse Wire Co., of Boston, and kindly loaned by them for this exhibit, are an amperemeter and a voltmeter manufactured by the Syracuse Electrical Instrument Co. Mr. Russell also represents them in New England, and says that they are getting very popular among the trade. For incandescent lamps, Mr. Russell handles the old and popular Beacon, which is so well known to the trade that nothing more need be said of it.

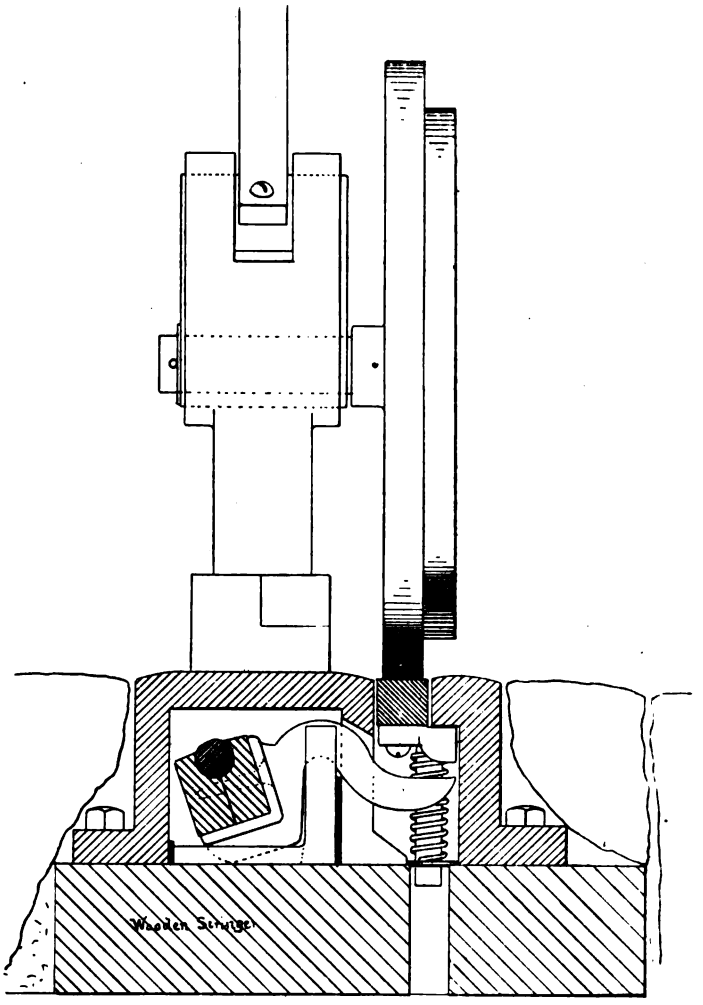
Frink's reflectors are also prominent in the exhibit. The business of I. P. Frink has increased considerably in New England of late, which is only a just reward for putting out the best that can be made at a price consistent with the quality of the goods. The new windows of Jordan, Marsh & Co., Boston, are to be fitted out with these celebrated window reflectors.

ELECTRIC TRANSPORTATION

The Third-Rail System as Applied to Electric Propulsion.

BY LOWELL MASON MAXHAM.

AFTER years of experimental work in an effort to devise a practical third rail, it has been clearly demonstrated that if we are to substitute the third-rail system in place of the present overhead trolley, the element of safety must bear an important part. With this end in view, it is quite useless to consider any form of a third rail by which the powerful electric current necessary is controlled in its essentials by the use of mag-



MAXHAM'S IMPROVED PROTECTED THIRD RAIL.

nets, switches, cut-outs, and the hundred and one schemes suggested, all offering innumerable opportunities for leakage, waste and short-circuiting, with the additional danger from electrical storms burning out, and the consequent stalling of the entire line. It is understood that this reference is made and applied to the various forms and devices intended for surface contact third rails, in lieu of the present overhead trolley.

It is conceded that a practical mode of electric street traction may obtain, by means of a suitable device placed within a deep and sustained excavation underground; yet this necessitates so heavy an expense as to prove a bar to all but a few of our largest traction companies, and cannot be considered as a popular substitute for the present trolley or as a practical device for our suburban steam lines which may desire to use the electrical current in place of steam.

Digitized by Google

The present trolley system provides a continuous and practically sure current, together with a safe and easy means of making electric contact quite free from the objections above noted.

This is conceded to be the strong point in favor of the present overhead trolley, and these same conditions should obtain (with the added element of absolute safety) in any form of a practical third rail. And not only this, but the item of cost of construction and maintenance should be little, if any, greater than now pertains to the present trolley system, in order to have it become of equally popular and general use.

The question now arises, How is this desired result to be obtained? The answer is: That in combination with an insulated and powerful electric current there should be a sure and safe secondary conductor by and through which the current can be instantly taken up or released from the main conductor and transmitted through the contact device to the motor on the car, and, in this way, complete the circuit from and through a normally dead rail acting as a secondary conductor.

Experiments heretofore made along these lines have failed both from faulty design and construction; and the problem has remained unsolved until, by the recent invention described in this article, the highly important results desired have apparently been achieved.

The Maxham surface contact third rail for street cars is formed of a series of normally dead rails, laid in insulated sections of convenient length between the service rails and parallel with them.

The powerful and dangerous electric current is safely insulated and carried normally out of contact below the surface and within the hollow part of these rails.

By purely mechanical action, whenever it is desired to move a car, this electric current is automatically and instantly put into circuit with that part of the top of the hollow rail under the moving car only. On the top of this rail moves the contact shoe through which the electric circuit is completed to the motor on the car, and return circuit in the usual manner, without the aid of magnets, switches, cut-outs or storage batteries.

This is accomplished by laying, parallel with the hollow rail, a guard rail, the two forming a slot or channel. Into this channel is placed an insulated depressible bar having a contact drop of one inch. This bar is held normally even with the top of the hollow and guard rails, thus closely filling the top of the channel, and providing a drain and discharge for any surface water into a sewer or catch basin connection. On the top of this bar rolls a depressing wheel, which is at all times under control of the motorman. Whenever this bar is depressed to move a car, it actuates a fulcrumed rocker arm or lever, one end of which extends into the hollow rail and forms a support for and moves the electric conductor into contact with the ceiling of the rail. Each section of this hollow rail has its own conductor sealed watertight within it, yet provides a continuous electric current throughout the entire line and leaves an absolutely dead surface rail at all times when the car is not moving.

The danger from lightning discharges, which obtain in the overhead trolley and many other systems, is quite eliminated in the Maxham rail, owing to the fact of its being set into or on the ground: it becomes a lightning arrester throughout the entire line, and having neither switches, magnets nor storage batteries controlling the current to be burned out, no possible harm or damage will occur in the severest electric storms.

The entire system, when laid, rests above or on the ordinary sleepers of the roadbed, the same as the service rails. The third rails are of sufficient weight and substance to stand the wear of the heaviest teaming in the cities, being laid on an even plane with the paved filling between the service rails.

In the outlying and suburban districts no filling between this and the service rails is required, except at the public crossings.

It is only necessary to add the Maxham contact shoe and a few feet of connecting wire to any cars now using the overhead trolley, to operate them just the same over any other line using the Maxham third-rail system.

The importance and advantage of this feature in the way of easy and economical connection with the various lines is obvious. Bear in mind that all of the exposed parts of the Maxham third rail are absolutely safe to step or walk on, without danger to persons or animals, the dangerous electric current being safely placed below the ground surface.

A practical demonstration of the Maxham electric third-rail systems is being given in Exhibition Hall during the twentieth triennial exhibition of the Massachusetts Charitable Mechanic Association, at Boston, Mass., from Oct. 10 to Dec. 3, 1898. This includes not only the Maxham protected surface contact rail for street traction, but also their electric third rail especially adapted to any elevated structure or to supplant steam on suburban railway traffic lines.

This exhibit has proved to be one of the most important and interesting, to railway managers and the public, seen there. No expense has been spared to have every mechanical and electrical feature of the system in complete operation, including their automatic electric switch and signal system in combination with their third-rail device.

The company's offices are located in the Tremont Building, Boston, where exhibits and full particulars are given to all interested callers.

An Electrical Survey in the Borough of Manhattan, New York City.[1]

BY A. A. KNUDSON.

ABOUT eighteen months ago the question was raised by some of the municipal officers of this city as to the possibility of electric currents leaking or straying to underground pipes from the conductors of the "open circuit" electric railway on Lenox avenue, and adjoining streets at that time, as applications had been made to extend this system.

A number of tests have been made by the author throughout the city, from Harlem River to the Battery, between various metallic structures, such as "L" (Elevated Railway) pillars, surface railways, water pipes, etc., and the results are given here, and may prove acceptable, and possibly of some value.

Previous to making any tests on the Lenox avenue line, we had a well settled theory that in a double conductor system as this is, very little, if any, of the current could be found diverted from the conductors to water or other pipes underground in its vicinity.

From the first, on the Lenox avenue line, unmistakable signs were encountered of railway current leakage from the rails of this road to both water and gas pipes, the sudden fluctuation of the voltmeter needle proving this beyond a doubt. It was noticed, however, that when a Lenox avenue car passed there was no advance of the needle as should be expected, and when two cars passed, going in opposite directions, there was no advance of the needle at the moment; continuing down the street and testing at each fire hydrant and gas post the voltage tended to increase upon nearing 135th street.

It appears from the tests made that an open conduit system, or one in which an insulated metallic return is used, effectually confines the current to the conductors provided for it. For this reason it is preferable to the ordinary ground return, especially in large cities, where the space below the streets is so largely occupied with various lines of iron pipes, more or less subject to electrolytic action.

Desiring to learn the difference of potential between the elevated railway pillars and water pipes with the Union Railway, if any, in this part of the city, tests were begun at 157th street (Harlem River), on the Eighth avenue line, and continued down as far as 109th street, which is the western terminus of the Metropolitan Company's open conduit system.

It was found that the current passes into the water pipes and "L" structure from the rails of the overhead trolley road at 135th street (they being positive) from 2 to 2½ volts maximum, then along the pipes for five blocks to 140th street, then reverses and passes along the "L" structure for another five blocks to 145th street, where it again reverses and takes the water pipes to another reversal at 157th street.

By inspecting the rails it was found that a large amount of metal has been removed from them by electrolysis. The original size of the rails was furnished by the company supplying the rails, being 70 pounds to the yard; furthermore, the bottom sides of all these rails were cut by the current down to knife edges for several feet back from the ends. These edges were irregular in shape and somewhat jagged in appearance.

Another feature of interest is the condition of the cross-bars or tie-rods, which keep the rails in position. These bars, which were originally 1½ inches wide by ⅜ inch thick, were nearly all so eaten away that the middle portion was missing, the ends protruding from the rails at from 6 inches to 12 inches.

[1]Abstract of a paper read before the A. I. E. E., October 26, 1898.

Digitized by Google

Indications of a trolley current having been found at the lower end of Manhattan Island, tests were made coming up on the east side and the current was found to come from the Brooklyn Bridge. Tests made at the New York entrance of the bridge gave the following results.

At one pillar there was a maximum of three volts, average 1½ volts, pillar positive to Third avenue cable rails. At another practically the same reading. Further up Park Row, at the corner of Chambers street, pillar positive to cable rails, 1 volt maximum; water positive to cable rails, ½ volt; pillar positive to water ⅓ volt.

In the light of present knowledge on this subject the very serious question presents itself to any practical mind here present, in what condition would we expect to find the anchor bolts and iron foundations of these pillars, if excavations were made at their base?

Next tests were made to determine, if possible, the movements of straying trolley currents and their possible effect on the cable terminals. At the Brooklyn tower the reading was 3¾ volts maximum, average 2¾, bridge structure was as before positive. At centre of span, structure positive at first, with 2¼ volts maximum, but during the readings there were two reversals, one of them only remaining long enough to obtain a reading, which was 1¼ volts maximum, structure negative. At the New York tower: structure positive to cable ground, with trolley variations ranging from ¾ to 3 volts, average 2 volts. At New York anchorage: maximum 2¾ volts, average 2 volts, structure positive to ground.

In conclusion, I would suggest that periodical tests should be made in every city by competent parties where a trolley road using a ground return is in operation, and the reports placed before those having authority to deal with the matter. In this way threatened damage by electrolysis to water and other pipes, as well as bridges, might be arrested and finally controlled.

Electrolysis of Cast-Iron Water Pipes at Dayton, Ohio.[1]

BY HAROLD P. BROWN, E. E.

THE injury of water pipes by electrolysis is at present so well understood, that my only excuse for again calling attention to the subject is found in the peculiar and unusual conditions disclosed at Dayton, Ohio, in an examination made last July. All of us know that electrolysis may be expected to injure lead and wrought-iron pipes on the lines of electric roads within a radius of half a mile from the power house, but we have believed that cast-iron mains were safe. Our faith has been rudely shaken by the condition of these pipes at Dayton. They appeared to be entirely uninjured and the black paint seemed to be unaffected. But on scraping the pipe with a knife, the metal was found so soft that grooves could be cut into it. Therefore sections were removed for mechanical and chemical tests, and the results fully justify your most careful attention, since your own pipes may perhaps be in a similar condition.

The business portion of Dayton is practically located upon an island, and the electric current used by the street cars must follow the rails across bridges or pass on the pipes under the river to get back to the power house.

At each hydrant along the electric roads of the city a reading was taken from the trolley wire to each of the four rails; from the trolley wire to the pipe and from the pipe to each of the rails. These measurements were made in sets of three in such a manner that any poor contact or any defective condition of the testing apparatus was at once indicated and corrected. The electrical tests showed that the pipes in the business portion of the city, one and a half to two miles from the power houses, were positive to the rails, and therefore subject to electric corrosion. The highest readings in this part of the city were 4½ volts near Fifth street bridge and near Washington street bridge. Near the power house on the west side of the river, the pipes were 9 volts positive to the rails, and the danger district extended about three-quarters of a mile to the west. In the southern part of the city the highest positive reading was 2 volts in front of the Oakwood avenue power house.

In making the electrical tests, the time of the reading was noted, since the pressure depends on the amount of load carried at the power house, and will vary correspondingly in all parts of the city. For instance, in front of the power house of the People's Railway on Washington street at 5 p. m. during the heavy load the pipes were 9 volts positive to the rails, while at 2 p. m. they were but 6 volts positive.

Unless a remedy for the electrical condition of the pipes is very quickly applied in Dayton, it is certain that a large amount of excavating, replacing of pipes and paving will need to be done.

Cast-iron pipe is usually little affected by electrolysis since the coating of adherent moulding sand and tar paint protect it. In the ordinary soil, an iron pipe submitted to electrolytic corrosion, is covered with a layer of iron oxide, which is a poor conductor of electricity, so that with a given pressure, the deeper is the layer of rust and the slower the rate of corrosion.

But to my surprise, the soil surrounding pipes in Dayton gives an entirely different reaction when a current passes through it. The tar seems to be no protection whatever, and the surface of the pipe in the danger district is changed into a soft black material resembling graphite, and easily cut with a knife. This material is such an excellent conductor that instead of checking, it tends to increase the action by reducing the resistance of the path through which the current must flow in order to reach the rail. Moreover the stones and pebbles near the pipes are actually electroplated with the metal of the pipe, whether iron or lead, as can be seen from the samples exhibited. This condition I had never before seen, and, as far as I know, it has not been previously reported.

The chemical analysis of the iron pipes showed that the percentage of iron was greatly diminished while the percentage of carbon was more than doubled; careful investigation showed that the carbon was merely the amount originally in the pipe, the carbon being left, while a large portion of the iron had been carried away.

The chemical analysis of the soil showed that the solvent was produced electrically from carbonate of sodium and chloride of sodium in the soil. Neither of these by itself in the small proportion shown by the analysis, would injure a cast-iron pipe covered with tar, though, as is well known, a strong solution of chloride of sodium or common salt will rust wrought iron.

But the presence of even 0.02 per cent. reduces the electrical resistance of the iron and the passage of the current decomposes these salts and forms muriatic or hydrochloric acid which dissolves the metals. Having thus determined the cause of the trouble, it remained to fix its extent. Fifteen excavations were made in different parts of the city to determine how much electrical pressure is required to seriously injure the cast-iron.

A pressure of 3 volts and less is found to cause a graphite coating not exceeding one thirty-second of an inch in depth; the iron seems to be uninjured.

From 3 to 4½ volts, the thickness of the layer is increased in a ratio depending upon length of time during which the pipe has sustained this pressure. With a knife or file, soft spots can be found in a pipe from one-sixteenth of an inch to one-quarter of an inch deep. With higher electrical pressures the extent of the injury is even greater. In all cases the damage is directly proportional to the pressure and to the length of time during which the current has been flowing; while it is inversely proportional to the distance between the rails and pipes.

In my opinion, all mains and service pipes in Dayton are seriously injured where submitted to 3 volts pressure or more for two years or more when within four feet of the rails.

I feel confident that if the railroads would unite in the expenditure of five to seven thousand dollars for the proper electrical apparatus and connections, all the water pipes in Dayton could be maintained negative to the rails. Then the pipes would harden, and any further electrolysis that might occur would be in the opposite direction, and would therefore add a layer of metal to the pipes instead of injuring them.

In conclusion I would like to offer a few comments and four or five practical suggestions.

Do not imagine because your pipes are not leaking and bursting, that they are safe from electrolysis. If the electrical conditions are against them, they are getting weaker day by day. On the other hand, do not antagonize the railway companies, the moment that the subject of electrolysis comes up in your city.

The best course for all concerned, it seems to me, is to take mutual action. Do not put down any more lead or wrought-iron service pipes, as these are the first victims of electrolysis, and

[1]Abstract. Read before the Mun. Impt. Assoc. at Washington, D. C.

Digitized by Google

their replacement means ruin to pavements. Use instead wooden pipe, banded with a close spiral of hoop-iron and covered heavily with asphaltum.

This will stand the heaviest pressure in use and is not affected by electrolysis, since the hoop-iron is low in conductivity and is not electrically connected at the joints. Its cost is said to be reasonable, and it has a successful record of many years' service.

Use the same kind of pipe for new mains in any district in which a railway power house is likely to be erected, and heavily paint the lead calking of cast-iron mains, using asphalt or petroleum wax.

In the danger district along the lines of electric roads and on intersecting streets, put into your water and gas mains two or more consecutive lengths of these wooden pipes so as to break the electrical continuity of the mains and thus make their resistance greater than that of the rails. Fill in the space around them with broken stone and connect with drain if possible.

Midway between the wooden sections on each main, attach insulated pilot wires, leading to a central office. Connect similar wires to the rails nearest the pipe wires and make daily electrical tests at times of heavy load. If any section shows positive to the rails, cut it at once into smaller sections, and call upon the railway to rebond its line upon that street.

This, with the proper electrical management of the railway feeder wires and apparatus, will effectively protect your mains.

The Vehicles of the General Electric Automobile Company.

BY R. M. HUNTER, M. E.

THIS company has its headquarters in the Bourse at Philadelphia, and was originated through the writer in the early summer of 1898. He has sold to the company seventy patents relating to electric propulsion of vehicles by storage batteries, among which were included the broad patents for series-multiple control issued to himself and to Condict, the patent to the latter being the one recently sustained in the suit prosecuted by the General Electric Co. (licensees) against the Walker Co. The General Electric Automobile Company maintain that these numerous patents practically entitle it to a monopoly of the electric carriage and wagon business when the vehicles are built in a commercially practical way. It is evident that this view of the situation is likely to lead to considerable litigation in the near future. The officers of the company are: Prof. Wm. D. Marks (until recently president of the Edison Electric Light Co., of Philadelphia), president; John H. Noblit, vice-president; Aubrey B. Pearson, secretary and treasurer. These gentlemen, with Colonel Clement W. Cox and Rudolph M. Hunter, constitute the directors.

The company is just completing arrangements for suitable buildings and machinery for manufacturing its own batteries with a view of cheapening the cost, and so as not to be dependent upon any outside concern for this essential part of its equipments. The buildings will also have ample storage room for vehicles. It further proposes to introduce small isolated charging stations at various places over the city for the convenience of its patrons.

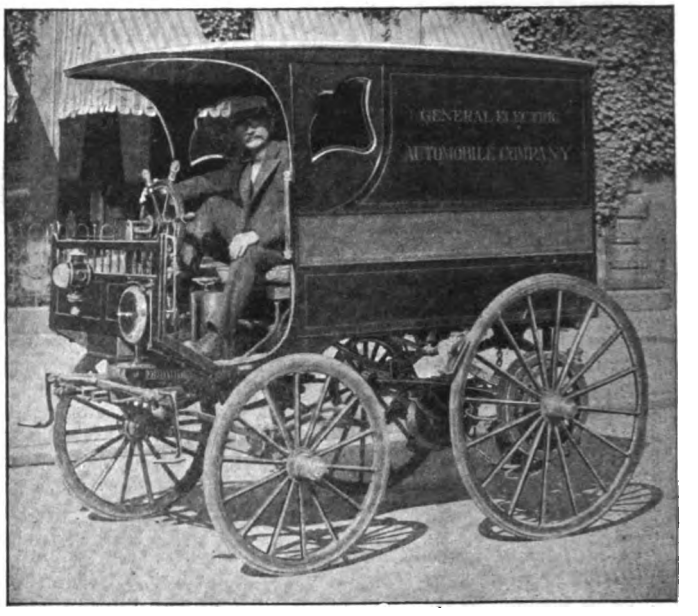


FIG. 1.—HUNTER ELECTRIC DELIVERY WAGON.

The present types of vehicles which the company have built and are now nearing completion are delivery wagons, physicians' and pleasure phaetons, and broughams or coupes.

The electrical equipment upon the several vehicles is substantially the same and will be explained later on.

The delivery wagons are provided with a fifth-wheel steering gear to the front wheels, controlled by a small hand wheel on a horizontal axis and operating through gearing a worm or tangent screw which works in a curved rack segment connected to the pivoted axle. This method of steering delivery wagons is preferred because the position of the axle is always locked, and excessive strains and jars cannot come upon the operator. It is found by experience that this steering gear works most successfully. It furthermore enables the most approved customary type of spring body support to be employed, which is deemed most advisable, and especially so is this for vehicles required to carry heavy loads. The batteries are arranged in trays and placed within a compartment under the rear of the body, and furnished with a spring floor to reduce the jarring upon the battery when traveling over rough roads or crossing railroad tracks. The bodies of the wagons are closed and handsomely trimmed. The wheels are fitted with anti-friction bearings and the rear wheels are independently driven by separate motors. The wheels are

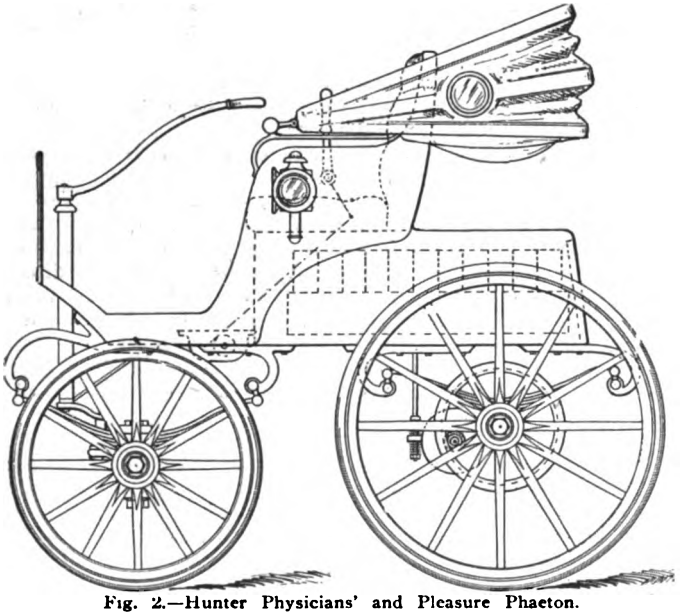


Fig. 2.—Hunter Physicians' and Pleasure Phaeton.

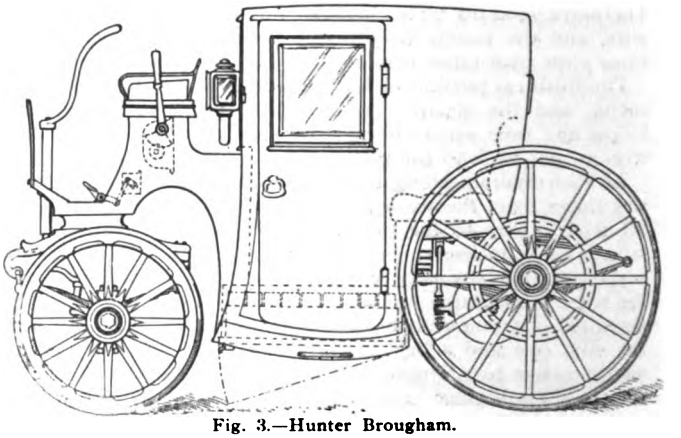


Fig. 3.—Hunter Brougham.

TYPES OF GENERAL ELECTRIC AUTOMOBILE COMPANY'S VEHICLES.

Digitized by Google

of wood with solid rubber tires. Pneumatic tires will not be used. Fig. 1 shows one of these wagons.

The phaetons for physicians' and pleasure riding is in design between a doctor's carriage and a stanhope, consisting of a seat for two persons with handsome upholstery and cushions side and back. The outside of the seat is built up solid and varnished. The battery compartment extends under the seat and backward with a drop-hinged door at the rear. A rich leather dasher relieves the front. A leather falling top is also provided, and this is furnished with round side bevel plate windows of small size. Handsome lamps, both for electric light and candles, are provided on the sides of the body. The running gear consists of two large rear and two smaller front wheels, all of wood, and having solid rubber tires. The front axle is carried upon springs secured to special iron extensions from the body, and the wheels are shifted for steering by knuckle joints and moved by a steering lever extending upward through the body near the dasher and leading backward toward the seat. The rear axle is also fixed and carried by a similar set of springs. The wheels are all furnished with ball bearings. The finish is treated in colors of royal blue, black and pin striping of yellow on the wheels. These vehicles are designed to give a light weight effect with rich, yet simple design. Fig. 2 shows general details of this type of vehicle.

The brougham is but very little larger than ordinary types of fine carriages of this class. In general design it does not differ materially from the best styles of Rogers or Brewster makes, with the exception of the front running gear, which is made similar to that of the phaeton, but heavier. In this vehicle the knuckle-jointed axle and movable wheels are preferred in place of using the fifth wheel, because of lightness, cheapness, quicker steering and improved design. The body part has a single seat as in a coupé, but where desired, a front three-quarter or drop-seat may also be added. The operator sits upon a seat at front, in all material respects similar to that of the regular horse brougham. The front wheels are small and rear wheels are large as is customary. The axle boxes are provided with roller bearings. The eye is not shocked by any abnormal changes in design from that we are accustomed to seeing, the company believing that any radical changes in design should come by degrees to avoid public aversion to riding in objectionably conspicuous vehicles. The motors are located under the rear portion of the body and geared to the large rear wheels. The batteries are placed within a compartment under the floor of the body, but so shielded and worked into the structure of the carriage, that it is not perceptible. This result is secured by having a false floor and making the doors fit down over the sides of the battery compartment. The front projection upon which the operator's seat is located is arched in form, just as in the modern brougham, and the controller is placed out of view under the seat. The battery compartment has the bottom hinged to drop at the forward end and permits the batteries and the trays to be withdrawn or inserted. When in position the bottom is raised and locked in place. The construction makes this vehicle somewhat shorter geared than a horse brougham of the same size. Fig. 3 represents the details of the brougham.

The electrical equipment of these vehicles consists of the following: There are 44 cells of battery coupled in such manner that for all normal work the cells are maintained in series, but for certain work, as in mounting very steep and short grades or starting exceptionally large loads, the cells may be temporarily arranged in two sets and these put in parallel. The batteries are automatically coupled up with the motor circuits on the vehicle, by simply sliding the trays into the compartments through the media of contact switches. While the batteries are adapted to be charged after removal from the vehicle, nevertheless the vehicle is provided with sockets for attachment plugs connected with the battery circuits, so that the batteries may be charged while in the vehicle, and these plugs are so constructed that it is impossible to make a wrong connection or reverse the polarity.

The motors are two in number and develop two horse power each on normal running, but may be worked up to twice that power for a considerable period without excessive heating. They are four-pole motors with the armature shaft carried in roller bearings. They each develop four horse power at 800 revolutions and operate on 80 volts. The fields are double wound so that the field coils of each motor may be thrown in series or multiple. The motors are hinged to the rear axle near the outer ends thereof and are supported from the vehicle body. The armature shafts extend close to the wheels and are fitted with pinions of 3½ inch diameter, working on annular gears of 22 inch diameter fastened to the spoke arms. The gears are of phosphor bronze and carefully cut. The ratio is 1 to 6.28.

The controller is placed under the floor in the phaetons and under the operator's seat on the box in the broughams and is operated by a hand lever. It is adapted to give four speeds and one brake action. It is of the well-known series-multiple type, the patents controlling which are owned by the General Electric Automobile Co. The first notch puts the two motors in series with the field magnet coils also in series. The second notch maintains the motors in series, but the two sets of field coils of each motor in multiple. The third notch throws the two motors in parallel, but connects the two field coils of each motor in series. The fourth notch maintains the motors in parallel, but also throws the two field coils of each motor in parallel. The brake action is accomplished by reversing the controller lever and throwing all connections as in case of notch "first," namely, all in series but with the motors short circuited upon themselves, causing them to act as braking dynamos. This is only resorted to in case of emergency or in descending steep grades. A foot brake is provided when desired for ordinary uses. In all of the working notches, one to four, of the controller the batteries are connected with all of the cells in series giving a maximum voltage of 88. On the fourth or parallel notch the speed is 19.8 miles per hour. In addition to the series-multiple controller there is an electric switch for throwing the battery cells in two series of 22 and these in parallel; and this is employed in connection with the parallel arrangement of the motors, namely, the third and fourth notches when the internal resistance and counter-electromotive force are lowest. This connection is only used in starting heavy loads or climbing steep grades. These various connections may be represented diagramatically as in Figure 4.

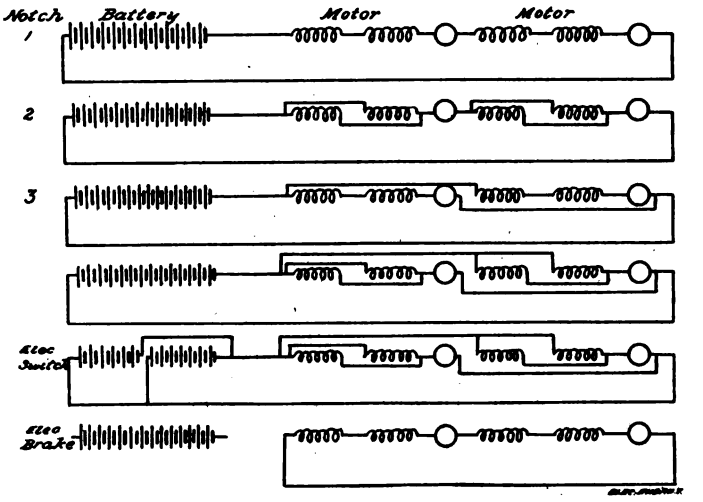


FIG. 4.—DIAGRAM OF CONNECTIONS FOR GENERAL ELECTRIC AUTOMOBILE COMPANY'S CONTROLLER.

In addition to these switches for controlling the speed and braking there is a separate hand controlled reversing switch to reverse the armature connections for running backward. In the phaeton these various switches and controller lever are arranged at the left hand side of the seat and extend up through the side rail and in convenient reach. This also enables the operator to sit on the side adjacent to the middle of the road and see more completely for steering and avoiding collision with other passing vehicles.

The General Electric Automobile Company is now arranging plans with a view of extensively introducing electric delivery wagons into the business of the large Philadelphia stores in place of the hundreds of wagons now moved by horses. It also proposes to establish carriage and cab vehicles for hire in all of the large cities and otherwise extend this coming mode of transportation. The company also intends in the near future to build all of its own motors as well as batteries so as to be wholly independent.

THE NIAGARA POWER is now to be used to run the inclined plane in the State Reservation Park, hydraulic power direct having been employed up to this time.

Digitized by Google

The Sprague Multiple Unit System on the Chicago South Side.

BY E. M. SHEPARD.

IN view of the misapprehension, evidenced by the article of Mr. J. R. Cravath in your issue of October 13, as to the working and performance of the "Sprague Multiple Unit System," a few statements from the writer may not be out of place.

The single excuse for the construction of an elevated road is "Rapid Transit," i. e., a high schedule. How to perform this efficiently is the economic problem.

Elevated railroad service is essentially acceleration. To accomplish any desired schedule by far the major portion of the energy used is thrown away in braking. This is necessitated by the frequent stops. The energy required to move a train over a given distance, regardless of that required for acceleration, is inconsiderable, even at the highest speeds attained in this class of service. The most economical performance of any given schedule is, therefore, that which wastes the least energy in braking. In order to keep down the braking speed a low maximum is required; for the attainment of this maximum in the shortest possible time, a rapid rate of acceleration is necessary.

Tests have been made in railway work which indicate that the limit to possible acceleration is not that of personal comfort, but of adhesion. This maximum acceleration can only be performed when every wheel of the train is a driver.

Apart from the consumption of electrical energy at the car, other considerations govern as to the economic acceleration. Each case is specific, and, therefore, must command independent investigation.

The equipment on the Chicago South Side Elevated Railroad is designed for the maintenance, with every car combination and all service conditions, of a fifteen-mile schedule. Each car is equipped with two motors of nominal 50 h. p. capacity each. The gearing is so determined that the maximum permissible current input will develop torque just sufficient to come within the slipping point of the wheels. All of the records of average performance of this equipment have been made with an adjustment of control operating inside of this maximum, which is the most efficient point of operation.

A reference is made in Mr. Cravath's article to single test runs made on the Metropolitan West Side Elevated road. A test run is no indication of the actual performance of a large equipment under the varying demands imposed by traffic conditions.

An unofficial report of the Metropolitan road for February, 1898, shows: "Average cars per train, 2.47; kilowatt hours per car mile, 3.39." This is for a schedule excluding the "loop," varying from 12.5 to 14.5 miles per hour, dependent on the size of trains, and the traffic. No deduction is made for losses in line, station lighting, and for a limited amount of car heating.

In order to maintain the fifteen-mile schedule on the South Side road (largely by reason of delays on the loop), runs are frequently made over the entire line at a schedule speed of, and even exceeding, seventeen miles an hour. A considerable proportion of the runs are made on this road at a sixteen-mile schedule.

This latitude of operation, while highly desirable from an operating position, and therefore from a revenue standpoint, does not conduce to the lowest average current consumption. The comparative current consumption per car mile is really in excess of the ratio of the squares of the schedule speeds. The average current consumption is, therefore, very considerably increased by some of the runs being in excess of the nominal schedule speed.

Individual runs made on the South Side road at an actual fifteen-mile schedule, with ten seconds stop at each station, show at the car an average current consumption of 1.54 kilowatt hours per car mile.

Any increase in acceleration requires at each car a proportionate increase in current. This, however, for a lesser time.

Fluctuations at the power house are dependent on the rate of acceleration, duration of the current input, number of units in circuit and upon their size. With only a few trains in circuit, fluctuations in current demand of considerable moment obviously occur.

The storage battery is a most efficient regulator, and by its proper use a uniform load can be maintained at the station, no matter what the fluctuations.

The cost of installation of power plants, including regulating batteries, is manifestly influenced by the rate of acceleration. It will be less for any given schedule with a motor equipment which is calculated to attain a high acceleration than for one which can only operate at a lower acceleration. Of necessity, any locomotive system must operate at a low acceleration compared with cars independently equipped.

Electric locomotives with trains of varying size must work a considerable portion of the time below their efficient loads. An independently equipped motor car has equipment designed to fulfill the service conditions of one car. I fail to see (neglecting entirely the greater efficiency secured with higher acceleration), how Mr. Cravath's criticism that "the use of so many small motors of course gives a lower efficiency than a single motor car at the head of a train" can hold for actual conditions of service.

The net result is the one to determine the real efficiency of any method of operation.

For any given schedule, lower first cost, lower cost of operation, greater facility of car movement with lower maximum speed and resultant greater safety, are features of the "Multiple Unit System" as compared with that of locomotive methods of operation.

To the far-reaching results of Mr. Sprague's pioneer work at Richmond must be added the successful installation of his new radical departure in railway operation, the "Multiple Unit System."

Electricity in the Philadelphia Peace Jubilee.

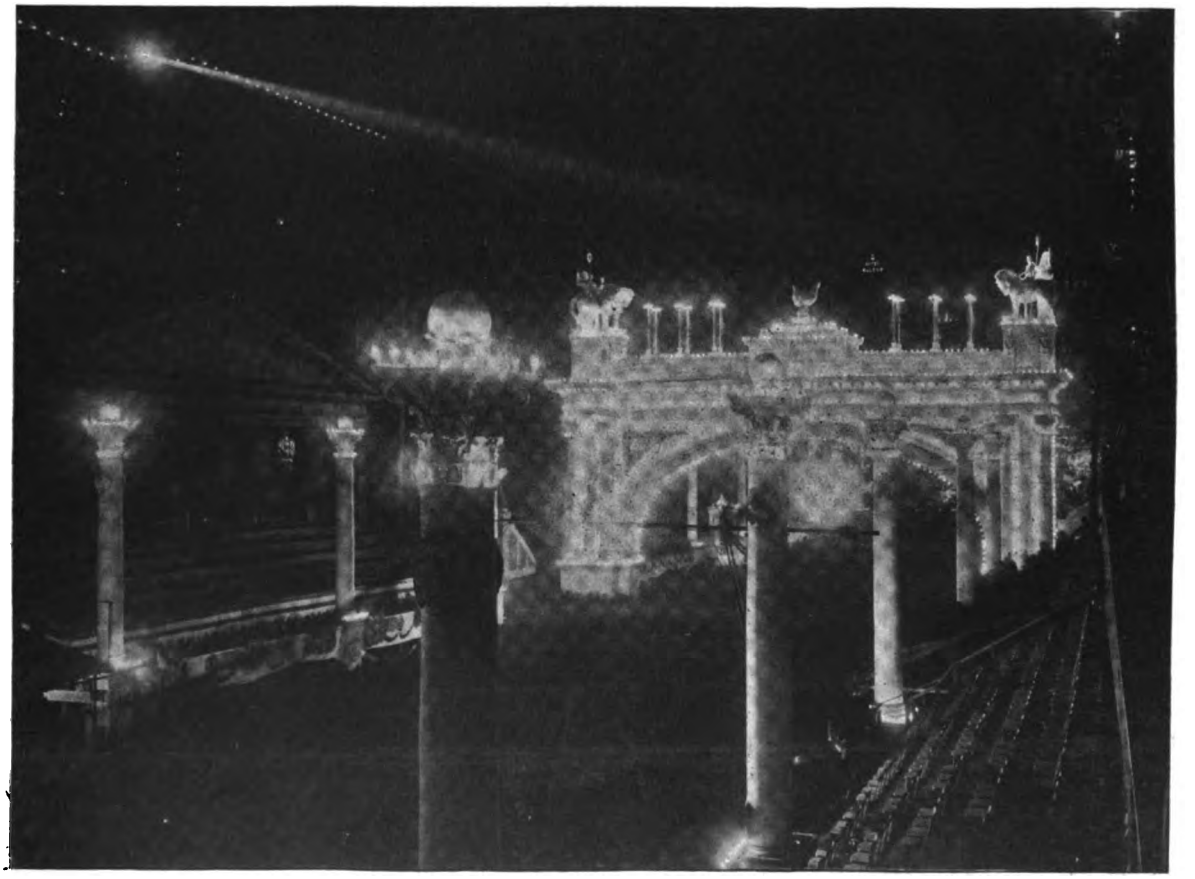
THE facility with which incandescent electric lamps lend themselves to the forming of artistic effects for public illumination was probably never more fully demonstrated than in its use for illuminating the Court of Honor, the Public Buildings and many of the office and private buildings in connection with the magnificent Peace Jubilee, at Philadelphia, between October 25 and 30. The celebration was conceived on broad lines and admirably carried out in every detail, and was a fitting recognition of the valor of American soldiers and sailors, the rank and file being equally honored. The recognition, however, of daring deeds and self-devotion to the country's cause was not more emphatic than the unconscious recognition of electricity and of the genius of the electrical engineers, who designed and produced the illuminating effects in such an incredibly short space of time. The pleasure afforded the vast throngs that filled the streets, to a late hour each night, and who hung about the scenes as if themselves electrified, or, rather, held by magnetic spell, was ample remuneration for the unknown heroes who worked early and late to accomplish the marvelous effects that were produced.

The most prominent feature of the demonstration was what was called the "Court of Honor," which was erected on Broad street, and extended a distance of five hundred feet to Walnut street. This court consisted of a row of columns on each side of the street, with a magnificent Corinthian arch at the middle, which spanned Broad street, adjoining Sansom. The material composing the columns and arch was plaster and staff, as white as snow. There were twenty-eight columns in all, the two initial columns on each end being larger and higher than the others, with the shaft reinforced on each side, with three projecting prows of naval vessels, surmounted by an American eagle of heroic size. These end columns were each fifty feet in height and four feet six inches square at the base. The intermediate columns were thirty feet in height and three feet square at the base. The square base was about ten feet in height and above this extended the shaft, terminating in a Corinthian capital, surmounted by a ball. Midway of the shaft on each side, projected a finely designed lion's head with open mouth. The faces of the base of the end columns next the street were provided with large shields, on which, in gilt letters, were the names of some of the recent naval battles, while the shields on the intermediate columns bore the names of prominent army and navy officers, together with a few of the heroes of lesser rank. The columns were bound together by cords supported from the lions' heads, and carrying small flags of every possible color and design.

The most prominent feature of the court, however, was the great arch, which was a combination of old Grecian and Roman

Digitized by Google

GRAND COURT OF HONOR, PHILADELPHIA PEACE JUBILEE. LOOKING TOWARD THE CITY HALL.
(Arch and Columns Outlined with Incandescent Lamps.)



COURT OF HONOR, PHILADELPHIA PEACE JUBILEE.
(Looking South From the City Hall.)

Digitized by Google

architecture, with a bit of Americanism thrown in, making a happy combination. The extreme width of the structure was 95 feet and the extreme height, to the top of the figures of the horses, by which it was surmounted, was 70 feet, while the arch itself had a clear span of 70 feet and was 35 feet in height. At each end of the top surmounting the cornice were two horses of heroic size, or, rather, 1⅓ of the ordinary size, standing side by side, facing inward, the riders of which represented Grecian victors returning from their conquest, each crowned with wreaths and bearing wreaths on staffs. Between each pair of horses was a short, heavy column, with bundles of flags, the whole designed to represent Peace, Victory and Strength. The pedestal for the horses was supported by four female figgures or Caryatides, two on a side, facing outward, and each holding an olive wreath. On a pedestal above the middle of the arch was mounted a large American eagle. Above the keystone, on each side, was a cartouch, being a copy from the shield of the city of Philadelphia. Between the main columns on each side of the arch were shields, the four bearing the names in gilt, of the President, the Vice-President and the Commanders-in-Chief of the Army and Navy. In the middle of the ornamental triangles, above the arch proper, on each side, was a large letter "P" in gilt. The inside of the arch, which was 13 feet wide, was composed of deep panels with rosettes. Above the keystone, on the north side of the arch, was the following Scripture quotation: "Ye shall know the truth and the truth shall make you free." On the south face was the following: "Then conquer we must, When our cause it is just; And this be our motto: 'In God is our trust.'"

The President's reviewing stand, also in staff, was located on the line of the side columns forming the court on the east side of the street, and was also classical in design. The balustrades were Corinthian, while the sides were composed of Ionic fluted columns and cornice, the whole being surmounted by a large ball. While occupied by the President, during the review on Thursday, the stand was decorated with flowers and flags, one of which was the President's own flag. The Court of Honor, including the arch, was an original design of Mr. Joseph M. Huston, architect, of Philadelphia, who, with his staff of draughtsmen, contributed their services without charge to the Committee of Arrangements.

The whole was artistic in every feature, and elicited most hearty commendation for the designer, from the President and from every one who had the good fortune to view its harmonious proportions. Considering the time allowed (only two weeks) for the design and execution of the work, it stands as a noble monument to the power latent in the minds of America's architects, engineers and mechanics, but which comes into manifestation when exigencies arise, not less than the valor and heroism of Army and Navy leaders. Included, of course, in the above were the electrical engineers and army of workers, both electrical and mechanical, who remained at their post night and day without flinching until the structure was completed and lighted. The illumination of the court required 4,000 incandescent lamps, of which 2,000 were on the arch. The illumination of the four end columns required 100 lamps each, and the intermediate, 68. These were placed in rows, one at the top of the pedestal and around the top and bottom of the capitols, while on the end columns the ship beaks were outlined with lights, as were also the lions' heads on the other columns. In the lighting of the arch the steps of the pedestal at the top, on which the eagle was mounted, were outlined with lamps, while there were 12 pole chandeliers, six on each side, between the eagle and the horses, each carrying 12 lamps. There were also rows of lamps on the top of the cornice, also between the brackets supporting the corners, along the outline of the spandrel at the top of the arch, and on each side of the main columns composing the end of the arch. There were two lines extending over the face of the arch on the under side where all the panels in the arch were outlined, as well as the rosettes in each panel. For conducting the current to the lamps there were three points of distribution established near the court, with suitable switches, so that should the wires of one cable fail the second could be used. Cut-outs were provided at each of the columns and the wires were conducted above the danger point in Loricated conduits. The wiring was all done by the Sawyer Electric Company, of Philadelphia, while the lamps and current were supplied by the Edison Electric Light Company.

Next to the illuminating effect of the Court of Honor stood that of the City Hall, for which there was an equipment of 6,000 incandescent lamps. These were put up in circuits 200 feet long, the lamps being placed 2 feet apart on a pair of No. 2 weatherproof wires, to which the sockets were attached by the terminal conductor, a section of the insulation of the wires being removed. With these all the tangent lines of the mansard roof were outlined as well as the corner and centre pavilions. As the building is 400 feet on a side some idea of the amount of work required can be formed. In addition to the tangent lines there were four streamers extending on the half points from near the top of the tower to the roof of the building, each being 400 feet in length. About the base of the Penn statue at the top of the tower were 16 arc lights and on the rim of the hat were fourteen 32 candle-power incandescent lamps. The main arches over each of the four entrances were outlined with lamps, while above the south entrance on large white scroll letters, as a background, the lights spelled the motto: "The spangled banner in triumph doth wave." The lettering was in white lamps, while in place of the word "star" there was a large five-pointed star in red, white and blue lamps. In addition to the lamp illumination there were four 18-inch projector searchlights, which streamed forth from the four sides of the tower just below the clock. The design and work of illuminating was under the direction of Mr. Edward Davis, electrical engineer of the building, assisted by his chief foreman, Mr. C. H. Slaughter, and the wiring was nearly all done by the wiremen and employees about the building, and great credit is due to all concerned for the manner in which it was done, especially to the faithfulness of the workmen who stood up to their duties for nearly eighteen hours a day without a murmur for the two weeks required for doing the work, and all was so perfect that not a fuse was blown when the current was turned on. The sockets for the lamps were purchased for the most part from the H. W. Johns Manufacturing Company, of New York, and were all specially manufactured for this order, while the lamps were purchased wherever a stock could be found, principally of the Columbia Lamp Company, of St. Louis, and the Sawyer-Man Co., of Philadelphia, while the searchlights were of the General Electric Company's make, and the arcs of the Helios type.

The current for lighting the City Hall decoration was generated by the plant in the basement, one unit of 200 k. w. capacity being added for the purpose. The former equipment consisted of two units of the same capacity, the generators being of the Westinghouse type, direct coupled to Ames engines. The current output for the week, including the usual lighting of the building with the illuminations, was 4,500 amperes.

Among the designs that attracted special attention was one on the front of the Union League Club House, just to the left of the arch, which consisted of a United States Court of Arms in colors, which was flanked on either side by a large American flag and the Union Jack, the whole being about fifteen feet across and of the most delicate coloring. There were other colored decorations on this building, consisting of stars and shields, while the limbs of the trees in front of an adjoining building were outlined in miniature colored lamps. The front of the Lafayette Hotel, just north of the arch, was illuminated with tri-color lamps in streamers and festoons, and all the adjoining buildings were decorated to a greater or less extent with illuminated designs, the principal one of which was a large anchor in white on one of the leading hotels.

The office buildings of the leading newspapers were illuminated in various styles, usually with colored lamps, that of the Inquirer being particularly attractive. The lamps were in streamers and festoons, one of which extended entirely across the street to the top of the buildings on the opposite side, the others from the end of a long staff projecting nearly half-way across the street. All of the principal theatres were also illuminated and many of the large stores. The most attractive of the latter was that of William Wanamaker, which consisted of white and green decoration. There were a large number of portraits in oil of the prominent officers of the Army and Navy, together with the President and some of the Cabinet, the frames of which were outlined in white lamps, between which were wreaths of green and numbers of white doves suspended by fine wires which gave them the appearance of being alive, and as they swung in the wind this effect was very realistic. On the Chestnut street side above the front of the John Wanamaker establishment were five large flags bordered by white lights, on each of which were spelled in white lamps the following names: Philippine, Ladrone, Hawaii, Cuba, Porto Rico. On the Market street side were also three pieces, the middle one being a large eagle with the

Digitized by Google

word "Peace," the other two being flags with the word "Freedom" on one and "Humanity" on the other. Odd Fellows' Hall, on North Broad street, had emblems of the links and stars in colors. All the leading theatres were profusely illuminated, the name of the play being usually spelled in lamps either white or colored. There were also hundreds of other office buildings illuminated. Nearly all the store windows had their additional equipment of electric lamps for the occasion.

Electricity also played a prominent part in the illumination of the warships in the river, and the ships also played their searchlights to the great gratification of vast throngs who flocked to the river front.

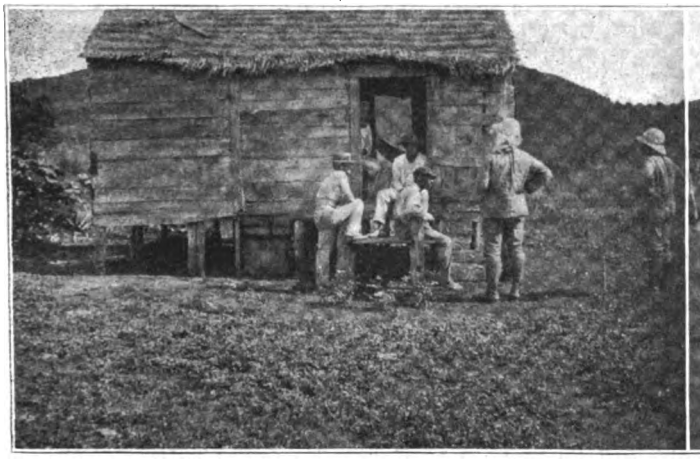
Colors for the First U. S. Volunteer Engineers.

SOME months ago the Engineers' Club of New York undertook to present the Volunteer Engineers with a stand of colors, and these colors have been on view at the Fifth Avenue club house awaiting a fit opportunity to deliver them to the regiment at Porto Rico. The occasion came last week, and the presentation was duly made to Col. Eugene Griffin in behalf of his regiment, at the club. Col. Griffin was struck down by dysentery while in the island, was ordered North to save his life, and has since then been slowly recovering at his home at Ardsley, on the Hudson. He was considered sufficiently well to return to Porto Rico last Wednesday, but, as the event proved, his health is still so poor, that the doctors refused to let him go until the present week, when he hopes to get away, with the intention of bringing his men home for Thanksgiving, unless further foreign complications arise. Col. Griffin has lost thirty or forty pounds and gives many signs of the ordeal he has been through.

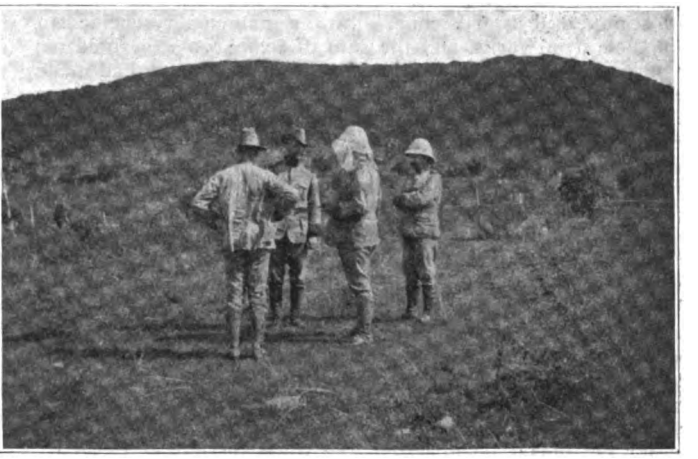
The presentation was made on Tuesday, Oct. 25, by Vice-President Mills, in the presence of a fair muster of officers and members brought together by the emergency call sent out. The main dining room was cleared out and the Stars and Stripes and the Regimental flag, both magnificent pieces of work, were placed there in a stand. Mr. Mills made an admirable address eulogizing the valor of the army and navy, and expressing the pride of the engineering professions in the regiment under Col. Griffin's command. On behalf of the regiment Col. Griffin, who was enthusiastically received, acknowledged the gift in a brief, but pithy and pregnant speech. He pointed to the singular fact that the Volunteer Engineers were the only national volunteer regiment, all the other volunteer regiments being State bodies with officers named by the Governors. The Engineers were raised under an act of Congress specifically and were in every sense as national a body as the regulars. He believed that the regiment was an invaluable corps of trained men, and that the precedent created in their organization would become most important. It was true the Volunteer Engineers had not had the good luck of other volunteers in getting their share of fighting, but the regiment had proved very useful and its services, he had reason to believe, were appreciated by the Army Department.

At the close of the ceremony, national airs were played by a band, the members were presented to Col. Griffin, and a collation followed.

It will be remembered that when the regiment left for the front, The Electrical Engineer published a number of pictures of it in camp and on the transport "Chester." We show herewith a couple of snap-shots taken after their arrival at Ponce. In one view, Col. Griffin is interviewing the natives in a country hut; and in the other, ground is being selected for a camp. It is true that the regiment was late in arriving at the scene of operations, much to its disgust, but the Spaniards, by their policy of destruction, left it plenty of work, and when the regiment comes home it will have proved its usefulness in a variety of ways. We can only express the hope that the boys may come back to eat Thanksgiving turkey with us, and that we may all have the gratification of seeing them march up Broadway with those handsome colors waving over them.



INTERVIEWING THE PORTO RICANS.



LAYING OUT A NEW CAMP IN PORTO RICO.

Space at the Paris Exposition.

The United States will have 210,000 square feet of floor space at the Paris Exposition. J. H. McGibbon, Director of Exhibits, Chicago, has received word from Commissioner Peck at Paris, saying that he had secured 35,800 square feet additional to what was obtained by Major Handy. This does not include the ground for a Government Building, space for an agricultural pavilion, in which agricultural implements will be installed and a fully completed railway train in full operation. Mr. McGibbon thinks it is probable that Commissioner Peck has also secured space in which to install the furniture exhibit. It is said that the American exhibits will be placed with those of England, Germany and Russia. The division of floor space will be about as follows: Educational department, sciences and arts, 12,000 square feet; general machinery and electricity, 59,000 square feet; transportation and civil engineering, 20,000 square feet; agricultural and food products. 24,000 square feet; horticulture, 4,000 square feet; forestry, chase and fisheries, 4,000 square feet; mines and mining, 8,700 square feet; general manufacture, 57,000 square feet; army and navy, 6,000 square feet; chemical industries, 5,000 square feet; social economy, 2,200 square feet; fine arts, 10,000 square feet. Applications for exhibition room are coming in rapidly, and Mr. McGibbon stated that they were from the largest manufacturing concerns in the country.

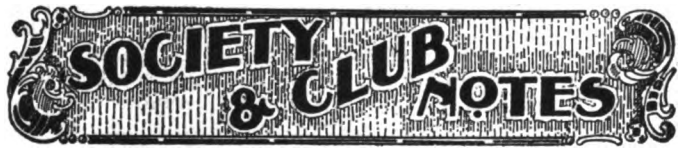
MR. FRANK NICHOLS PHILLIPS, president of the American Electrical Works, Providence, R. I., is to be married on November 15 to Miss Edith Remington Peck, daughter of Mr. and Mrs. L. R. Peck, of that city. The event is one of much interest to the electrical community, to which the name of Phillips is so well known and where it has always been held in honor and esteem.

MR. A. C. GARRISON. The marriage is announced for Nov. 9, at the Central Presbyterian Church, St. Louis, Mo., of Mr. Arthur Clifton Garrison, secretary and treasurer of the Columbia Incandescent Lamp Co., to Frances, daughter of Mrs. Rolla L. Billingsley. The groom is well known in the electrical field, and enjoys the friendship in it of a great many who will join in wishing him and his bride all happiness and prosperity.

Digitized by Google

The Municipal Gas Fiasco in Vienna.

Municipal parties in Vienna, Austria, have been in hot dispute over the concessions granted to an English gas company prior to Burgomaster Lueger's administration. This company, which is called the Imperial Continental Gas Association, contracted several years ago to supply the Austrian capital and suburbs with gas. By notification given prior to Oct. 31, 1896, the town could obtain possession of the entire plant of the company for $6,750,000, Oct. 31, 1899. But before the first date was reached the company offered the gratuitous possession of the plant to the municipality at the end of twenty years, and an immediate participation in the profits amounting to not less than $400,000 a year. In the meantime, however, the Lueger Anti-Semitic faction had secured a majority, and the campaign cry was to turn the English out at all costs. In a speech delivered Oct. 27, 1896, Dr. Lueger said, addressing the opposition, who were in favor of purchasing the works: "I have broken your power in three years, and just as I have smashed the Jews, so I shall have finished with the English in another three years. On the stroke of midnight, Oct. 31, 1899, the last Englishman shall have disappeared from Vienna." So the municipality decided to build their own works, and the sum of $9,000,000 was voted for the purpose. But is seems that the English company had made contracts with suburban towns which were later incorporated within the city to supply them with gas. The city government of Vienna attempted to repudiate these contracts, but was defeated in the courts. In the meantime, the city has spent $12,500,000 on the works, and it is now estimated that the total cost will be $15,000,000 to light the city proper alone. The city, however, could not displace the 60,000 meters of the company until the company's contract expired. At this juncture the Englishmen gave the finishing touch to the defeat of Lueger's scheme by offering to reduce the price of gas. After violent discussion among the city fathers the time of the English company's contract in the suburbs has been extended; the town agrees to take the English meters in the city proper at valuation, and at the expiration of the new contract in 1911, the town will be compelled to take over the company's entire plant at a valuation. As a result of Lueger's legislation, the town instead of receiving without trouble and inconvenience the plant for only $6,750,000 has thrown away $12,500,000 on a worthless plant and must still pay $6,750,000 in 1911.



Brooklyn Trip of the New York Electrical Society.

THE arrangements noted in our columns last week for the visit of the New York Electrical Society to the stations of the Brooklyn Edison Co. on Oct. 27, were duly carried out, and the event was a brilliant success, thanks to the hard work of Messrs. Doty, Barstow, Outwater, Peck and others in behalf of the company, and of Mr. Guy, the society's indefatigable secretary. No fewer than 240 members participated, and the fineness of the evening made the trolley ride from the home sub-station in Brooklyn to the main generating station at Bay Ridge, six miles away, very pleasant. The visitors were handled in parties, each with an expert guide from the company's staff. The earlier parties to start out were given a collation on their return at the "Citizen's" sub-station. The later parties had their collation served on the parlor cars en route, to save time—a most thoughtful and happy plan which worked to a charm. The caterer was Maresi, and in other respects also the hospitality of the company was shown. Nothing could have passed off more smoothly and successfully.

Before starting off, the society held a short business meeting in the company's lecture room at Pearl street, under president Dunn, when the following new members were elected: C. E. Speirs, D. Van Nostrand & Co., Murray street, New York; H. Ward Leonard, Bronxville, N. Y.; H. P. Davis, 918 Union street, Brooklyn, N. Y.; J. C. Slack, 123 Oak street, Greenpoint, Brooklyn, N. Y.; J. H. Mason, 152 East Twenty-third street, New York; W. F. D. Crane, Reynolds Terrace, Orange, N. J.; Dr. F. S. Kolle, 273 Prospect avenue, Brooklyn, N. Y.; W. A. Brown, Jr., assistant chief electrical engineers, Pennsylvania R. R., Broad Street Station, Philadelphia, Pa.; F. D. Sweeten, junior member Vallee Bros. & Co., 625 Arch street, Philadelphia, Pa.; W. A. Brown, chief electrical engineer Pennsylvania R. R., Broad Street Station, Philadelphia, Pa.; C. Shirley, New York manager Mass. Office Postal Tel. Cable Co., 253 Broadway, New York; A. E. Chandler, Postal Tel. Cable Co., 253 Broadway, New York; E. J. Powers, 45 Cedar street, New York; B. F. Hamilton, 510 West Twenty-third street, New York; M. L. Newman, E. E., 107 East Ninetieth street, New York; L. Strauss, 120 East 117th street, New York; G. H. Condict, chief engineer Electric Vehicle Co., 1630 Broadway, New York; J. Appleton, chief engineer Construction Department Electric Storage Battery Co., Drexel Building, Philadelphia, Pa.; Dr. J. F. Chauveau, Jr., 216 West 103d street, New York; G. N. Moore, assistant superintendent Edison Electric Illuminating Co., Fifty-third street station, New York; J. J. McKenna, Maintenance Co., St. Paul Building, New York; H. B. Kirkland, 120 Liberty street, New York; A. L. Goldschmidt, 425 East Fiftieth street, New York; J. J. Breslawsky, Leonard & McCoy, 118 Liberty street, New York; 1735 Madison avenue, New York; J. T. Hunt, Zimdars & Hunt, 127 Fifth avenue, New York; Wm. M. Stewart, New York Telephone Co., 15 Dey street, New York; H. Dowie, 363 Jefferson avenue, Brooklyn, N. Y.; H. D. Torrie, Jr., Riverside, N. J.; H. M. Jackson, president People's L. & P. Co., Newark, N. J.; Dudley Farrand, People's L. & P. Co., Newark, N. J.

American Institute of Electrical Engineers.

THE 128th meeting of the Institute was held at 12 West Thirty-first street on Wednesday, Oct. 26. President Kennelly in the chair. A paper was read by Mr. A. A. Knudson on "An Electrical Survey in the Borough of Manhattan, New York City." The discussion was opened with a communication from William Maver, Jr., continued by Townsend Wolcott, Jesse M. Smith and others. The president announced that a committee on co-operative research had been appointed in accordance with the instructions from Cornell. The committee consists of Dr. A. E. Kennelly, chairman; Prof. W. A. Anthony, Dr. F. B. Crocker, Dr. C. T. Hutchinson, Dr. Samuel Sheldon, Chas. P. Steinmetz and Prof. E. Thomson. The purpose is to formulate a system of experimental research, by submitting to various colleges and universities various problems which are of practical importance. The committee starts off with a list of sixteen subjects, and will expect members to send in others which may occur to them in the course of their practice. The results when received, if deemed important, will be published in the Transactions. The plan is receiving hearty support.

At the meeting of the Executive Committee in the afternoon the following associate members were elected: John McL. Murphy, electrical engineer, Safety Third Rail Electric Co., 5 Beekman street, Room 223, New York; F. K. Vreeland, second assistant engineer, Crocker-Wheeler Electric Co.; residence, 228 Orange Road, Montclair, N. J.; J. E. Woodbridge, editor "Electrical World," 9 Murray street, New York. The following associate members were transferred to membership: C. H. Wordingham, city electrical engineer, Manchester, England; William Stanley, electrical engineer and inventor, Pittsfield, Mass.

An Electrical Theatre Party.

IT has become quite the fashion to participate in large theatre parties, and of these, one of the most successful was that which visited Wallack's Theatre on Oct. 25, to see the "Fortune Teller" comic opera, as representative of electrical interests in this vicinity. The organizing committee was Mr. H. W. Baker, chairman; Mr. H. B. Kirkland, secretary; Mr. J. H. Dale, treasurer, and Messrs. J. T. McKever, Jr., E. S. Keefer and F. W. Harrington. During the performance an electrical bouquet with lamps fed by concealed batteries was presented to Miss Nielsen by the party, which occupied the front rows

Digitized by Google

in the orchestra. After the performance, the party proceeded in hansoms furnished by the Electric Vehicel Co. to the Waldorf-Astoria, the whole trip for all occupying less than fifteen minutes. A very choice supper was served in the Waldort dining room, to which the Marie Antoinette room, the Turkish room and the adjoining suite were annexed for the occasion. Music and flowers were provided by the committee, and guides were furnished for all who wished to inspect the wonders of the beautiful hotel. The ladies and gentlemen participating were as follows: Mr. and Mrs. Henry B. Cutter, Mr. and Mrs. Victor C. Gilpin, Mr. and Mrs. Chas. H. Howard, Mr. and Mrs. Philip H. Klein, Jr., Mr. and Mrs. Harris W. Baker, Mr. and Mrs. A. T. Clark, Mr. and Mrs. Leonard F. Requa, Mr. W. B. Vandewater and lady, Mr. and Mrs. C. A. Benton, Mr. and Mrs. E. R. Knowles, Mr. H. B. Kirkland, Mrs. Hermann Simon, Mr. and Mrs. John H. Dale, Mrs. Mary F. Kelley, Mr. J. S. Douglas, Mr. and Mrs. E. A. Lowe, Mr. and Mrs. J. Jones, Jr., Mr. and Mrs. D. E. Drake, Mr. and Mrs. E. S. Keefer, Mr. and Mrs. Alex. Henderson, Mr. and Mrs. E. F. Peck, Mr. and Mrs. J. C. Hatzel, Mr. E. W. Irwin and lady, Mr. F. A. Muschenheim and lady, Mr. and Mrs. T. M. Hartyn, Mr. and Mrs. John T. McKever, Jr., Mr. and Mrs. P. M. Fletcher, Mr. and Mrs. John Hunt and Miss Hunt, Mr. Geo. D. Pitman, Col. R. B. Edes, Mr. F. C. Bates, Mr. and Mrs. F. W. Harrington, Mr. and Mrs. E. P. Morris, Mr. and Mrs. N. W. Gage, Mr. and Mrs. W. C. Turner, Mr. and Mrs. W. J. Johnston, Mr. and Mrs. Oscar Hoppe.

LETTERS TO THE EDITOR

Operation of the Chicago South Side Railroad.

A short time ago Mr. J. R. Cravath requested us to furnish him with data and curves to enable him to prepare an article on storage batteries recently installed for the South Side Elevated Railroad Company of this city. We gave him the data and curves requested, and are very much annoyed to note an article in your issue of the 13th inst., entitled "Study of the Storage Battery Performance on the South Side Elevated Railroad of Chicago," written by J. R. Cravath, in which it is clear that the information furnished by us has been coupled with an uncalled for attack on the multiple unit system, and under the shelter of our name as consulting engineers of the road.

We have not furnished any data to Mr. Cravath that would warrant such an attack as he has seen fit to make, and he has done it entirely on his own account, and we desire this fact to be made known to the readers of your paper.

SARGENT & LUNDY.
(By F. Sargent.)

Chicago, Oct. 17, 1898.

(In reply to the above, Mr. Cravath writes us: "I endeavored to state the facts as accurately as possible, and if there are any errors in the article I shall be glad to correct them." Mr. Cravath also says he had not the slightest intention of suggesting that the article should be credited to the firm and adds: "I trust none of the readers of The Electrical Engineer would consider it as coming from the consulting engineers by whose advice the mutiple unit system was installed."—Eds. E. E.)

THE STOCK MARKET

Irregular and Active Trade.

THE prospects of trouble between England and France last week led to a very active grain trade with rising prices and large shipments, and flour production records were broken. General conditions were also good, the returns of New York State industries showing 52,000 more people employed than last year, although on a business 40 per cent. more profits are said not to have increased proportionately. Bank clearings were larger again, and railway earnings also, while the high rates of ocean freight tell the story of the enormous expansion of exports, manufacturing as well as agricultural. The decision of the United States Supreme Court against joint traffic arrangements between the railroads has not affected the roads, which are said to hope for legislation enabling them to maintain fair rates.

During the past week, 6,164 shares of Western Union were sold, opening at 91⅜ and closing at 92½. Of General Electric, 4,052 shares were sold, opening at 79 and closing at 82. New York Edison, on sale of only 720 shares, made a big jump from 128 to 141. Metropolitan Street Railway sold 17,236 shares around 160⅛. American Bell Telephone declined one point, to 276, and Boston West End Railway rose ¾, to 86¾.

TRADE NOTES AND NOVELTIES

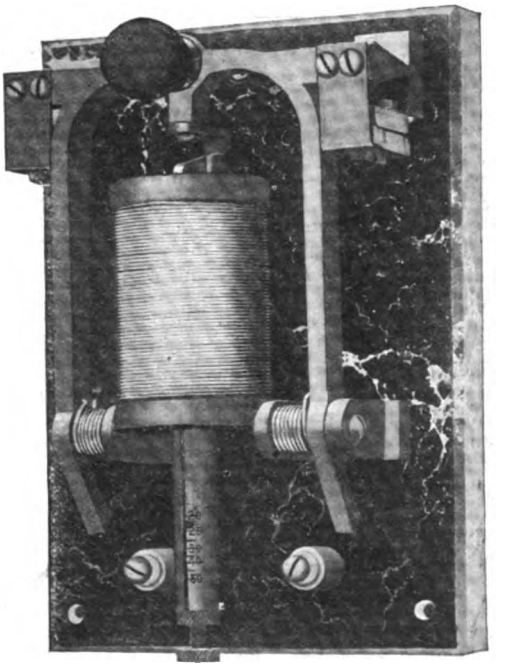
Crocker Wheeler Electric Power Machinery.

The Crocker-Wheeler Electric Company have recently issued Bulletin No. 7, which gives valuable data on electrical power machinery manufactured by that well known firm. A full description of direct current dynamos and motors with numerous cuts, belt-driven and direct connected, is given, as well as motor dynamos, dynamoters, mill motors, elevator motors, fan motors, etc. It is one of the most complete catalogues of its kind recently come to our notice and will be sent to anyone on application to the company.

A New La Roche Circuit-Breaker.

THE cut herewith illustrates a new type of single pole circuit breaker manufactured by F. A. LaRoche & Co., Thirteenth and Hudson streets, New York City. This type is also made with over and under load attachments for motor work. It is especially adapted for high voltages ranging in the neighborhood of 2,000 volts, and is guaranteed to break 2,000 volts successfully without arcing at the clips.

This feature is accomplished by the method in which the carbons are attached to the breaker. It will be noticed that the carbons are parallel to the clips, and as the breaker opens, the carbons attached to the blades open with a cam motion which keeps a rubbing contact on the stationary carbon until the



LA ROCHE CIRCUIT BREAKER.

Digitized by Google

blades themselves are well out of the clips and at a safe distance. Then the circuit is finally broken through the carbons and below the clips, so that no burning of the clips or blades can possibly take place.

The blades are of the wedge type and close into "V" shape clips. These are laminated and flexible to an extent, so that they adapt themselves to the shape of the blades, and absolute tight contact is thereby formed. The latch and trigger are made of case-hardened steel and are of the compound lever type, so constructed as to permit of a very weak solenoid being used, as the force of the blow required to operate the breaker will be very small. This method of construction is new in this style of instrument.

The hinge posts and blade arms do not carry any current, and it will be noticed, by referring to the cut, that there are two phosphor bronze springs in each hinge. These springs are quite weak, and only sufficiently strong enough to give the switch a quick and sharp break. Owing to the peculiarly shaped blades and clips, it is an absolute impossibility for the circuit breaker to stick, and the construction of the clips tends to throw the blades out by their own action. This breaker would really operate without these springs in the hinge, the springs being there only to assist in quickening the motion.

On the bottom of the lever arms are two projections which are parts of the blade frame, and come in contact with a buffer, so that when the breaker is opened and performing its function, the blow on the hinge post is reduced to a minimum.

Underneath the solenoid is a copper tube upon which is marked the calibration in amperes and fractions thereof. Upon the end of this tube is a milled head screw and nut which admits of adjusting the circuit breaker to open at any desired point within its guaranteed high or low ampere ratings.

These circuit breakers are handsomely finished in copper throughout, no brass or iron being used. They are mounted on either white marble or marbelized slate bases, as may be desired, and require no remounting, as each breaker is provided with binding posts. It will operate in a box or panel board, requiring only five inches depth, and it is simply necessary to run a wire to said binding post without any other connections or mounting.

Special care is taken in calibrating these instruments, and they are as reliable as an amperemeter. They are made in sizes from 15 amperes up to 500 amperes. Above that, the manufacturer recommends the "Victor" No. 1 circuit breaker or the "Ideal" circuit breaker, both of which are manufactured by the firm of F. A. LaRoche & Co.

The Bullock Electric Mfg. Co.

The above company are preparing now to move out to their new shops in Norwood, Ohio. The machine shops have been finished for some time and the company could have moved in by this time, if they themselves had been in a position to move. The company have been so rushed with orders that they could not spare the time to build the electrical apparatus they will need for their own use in Norwood. They are building two large generators, which are to be direct connected to a cross-compound engine built by the Lane & Bodley Company, of Cincinnati. These generators are to furnish power for the machine shop, which is to be driven entirely by electrical power. As soon as these generators are completed, the company will move. The process of moving will be done in as short a space of time as is possible. The company has booked a good many orders in the last month and are in a very busy condition.

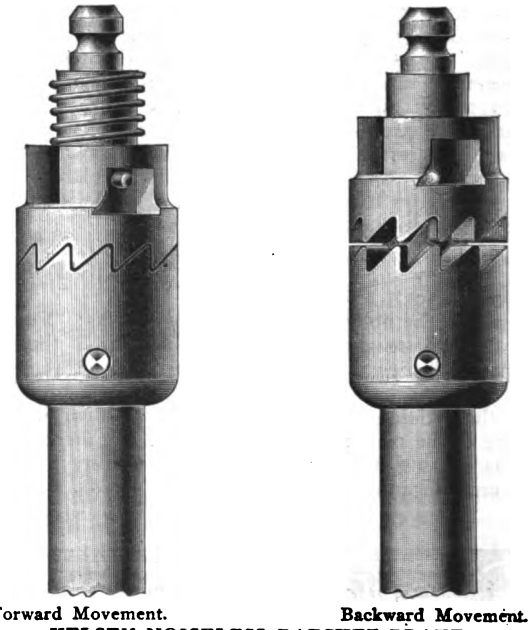
It is rather interesting to note the orders for the various different types and sizes of machines for direct current the Bullock Company has received during the last month. This company has lately gotten out a new type of enclosed motor for use in factories and machine shops for direct connection to cranes, machine tools, etc. This is still being changed somewhat and will not be ready to illustrate for a couple of weeks. The Pacific Coast Borax Company ordered ten of these motors, amounting to 160 h. p., to be used to gear to various tools. The Midland Steel Company ordered these motors for their traveling cranes, and the Bullock Company lately received two more orders for these motors directly in headstock of lathes.

The New York "Sun" has just ordered from the Bullock Company another 30 h. p. press equipment, to be a duplicate of the equipments the company furnished them before. This equipment is for the Bullock teaser system. The Toronto "Globe" also have ordered from the Bullock Company a like equipment of 40 h. p. for a large Hoe press. Unwin Bros., of London, have ordered another press motor like their last. The Bullock Company also have entered orders for a couple of generators for direct connection to gas engines, and a 100 h. p. motor and 150 k. w. generator, slow speed, three bearings, for J. B. King, Roslyn, Long Island. Besides the above, the Bullock Company have received many orders for their standard apparatus.

The Kelsey Noiseless Ratchet Brake.

THIS brake, manufactured by the Billings & Spencer Co., Hartford, Conn., and illustrated herewith, is not only noiseless, which is a great feature, but saves all the wear on the teeth, which most other brakes are subject to when the handle is turned in a backward direction. When the handle of the Kelsey noiseless rachet brake is turned in a backward direction the teeth are raised clear of each other, as shown in the figure, and held there so long as the handle continues to be turned in that direction, hence there is no noise or wear on the teeth. As soon as the handle is turned in the forward direction, or direction to apply the brakes, the spiral spring will force the upper member down into engagement with the lower member, as shown in the figure. The style of clutch is too well known to require any mention of its strength and durability over any single pawl and rachet brake. The handles are made of the best composition and highly finished and the clutch members are of the very best material.

KELSEY NOISELESS RATCHET BRAKE.



Forward Movement. Backward Movement.

KELSEY NOISELESS RATCHET BRAKE.

THE FARR TEL. MFG. CO., Chicago, have just placed on the market a new magneto bell at a popular price, which has met with instantaneous success.

Digitized by Google

St. Louis as an Electrical Centre.

It has become a well known fact with the electrical trade that St. Louis has made some very rapid strides during the past five years toward making it one of our prominent electrical centres. Every effort has been put forth by the manufacturers and electrical supply houses to accomplish this result, until to-day many of the prominent articles of electrical merchandise are manufactured there, and many, if not all, of the well known manufacturers of the country are represented. One of the most prominent electrical supply houses in the West is located there, and is fully deserving of its share of the credit for the effort it has made in bringing about this result. The house referred to is the Western Electrical Supply Company, which has not been slow to grasp the situation and has made great strides in the electrical supply business, until they now have a most extensive trade, and one which it has certainly earned by its efforts to bring St. Louis prominently forward in the electrical field.

Formation of the Diamond Meter Company.

The Diamond Meter Company, of Peoria, Ill., inform us that they have purchased all of the machinery, stock and material of the Diamond Electric Company, and will continue the manufacture of the Scheeffer wattmeters and Scheeffer transformers. They will aim to retain the quality and high efficiency heretofore enjoyed by these goods. They have no connection whatever with the Diamond Electric Company, and no Chicago office, hence all correspondence should be addressed to the company at Peoria, Ill. They will be prepared to fill all orders promptly. The officers of the company are: E. H. Couch, president; A. B. Fink, secretary; G. A. Scheeffer, engineer, and W. H. Heyle, director.

"Stone City" Telephones.

The Stone City Telephone Manufacturing and Construction Co., of Joliet, Ill., are putting a line of telephones on the market which range in cost from $2.25 to $15 each. The cheaper telephone is a serviceable instrument, but the price is put down low enough to tempt experimenters and others to purchase it, while for ordinary purposes it is claimed to be a very useful instrument.

ADVERTISERS' HINTS

RASTER CARBON RHEOSTAT CO., 231 South Canal street, Chicago, Ill., say that their patrons can tell more to the credit of their rheostats than they could induce people to believe. They will gladly furnish catalogue, prices and information to those interested.

ELECTRIC STORAGE BATTERY CO., Drexel Building, Philadelphia, Pa., are installing two batteries for the Metropolitan Street Railway Company, of New York.

CHICAGO GENERAL FIXTURE CO., 169 Adams street, Chicago, Ill., show a style of fixture which combines neatness and beauty. This is but one of their many styles.

RUSSELL ELECTRIC MFG. CO., 212 Eddy street, Providence, R. I., are advertising the well known Russell mast-arms, hoods and cut-outs. One of the features of their system is that no wires are exposed. Their catalogue may be obtained.

ELECTRIC APPLIANCE CO., 242 Madison street, Chicago, Ill., advocate the use of their new combined fuse block and lightning arrester for telephone circuits. They say it affords absolute protection and is indestructible.

R. SCHANDA & CO., 345 East Eigthy-second street, New York, furnish fuse links, fuse wire and specialties for light, power and railway service. They make them in capacities of 1,000 to 10,000 amperes. Their latest price list is ready for distribution.

O. C. WHITE CO., Worcester, Mass., are advertising adjustable fixtures for incandescent lamps designed to meet the requirements of libraries, factories, shops, etc. Their catalogue "K" tells all about them.

QUICK REPAIRS is the specialty of the Chicago Armature Company, 14 and 16 North Canal street, Chicago, Ill.

WILLIAM T. PRINGLE, 1026 Filbert street, Philadelphia, Pa., claims to be the manufacturer of the best receptacle and attachment plug. He says his new style is the latest thing in this line.

GENERAL ELECTRIC CO. are advertising Brush arc generators of large and small capacities. Two or more circuits may be run from one machine with any distribution desired.

SIPE & SIGLER, Cleveland, Ohio, have something to say regarding a public test of a Willard central station battery. They say that their frequent claims of the superiority of their battery have been made in the most perfect good faith, and that experiments continue to justify their claims.

McINTOSH-SEYMOUR CO., Auburn, New York, N. Y., show four gridiron valve engines just installed in the new plant of the U. S. Electric Lighting Company, Washington, D. C. The details of this installation are to be found in an article descriptive of that station which appears in another part of this issue.

WESTERN NOTES

THE WESTERN ELECTRIC CO. has distributed a number of its bulletins, No. 7002, which are descriptive of arc lamps of its manufacture. Any person interested in the operation of an arc light plant and who has not received a copy of this bulletin will be sent one upon request.

SIEMENS-HALSKE. The general Eastern office of the Siemens & Halske Electric Co. of America has been removed to the Land Title Building, Philadelphia, Pa. Their New York office, for local business (Metropolitan District), is now located at Room 511 Cable Building, 621 Broadway, New York City.

ST. LOUIS, MO. The steady supersession of the open arc lamp on multiple circuits by the enclosed arc lamp is remarkable. Within the past few months the Missouri Edison Electric Light Company, of St. Louis, Mo., has placed not less than 700 General Electric single globe enclosed arc lamps upon its alternating current circuits. These are used for interior illumination, and are giving satisfactory service. They replaced 18 ampere 30 volt open arc alternating lamps.

CHARLES E. GREGORY CO. By order of the court, Judge Carter presiding, the Charles E. Gregory Company, of Chicago, have purchased all visible assets of the defunct Electrical Exchange, which assigned Sept. 22, 1898. In order to save the expense of moving this stock, they are holding a bankrupt sale of supplies and machinery. Everything sold there is guaranteed to be as represented and some big bargains can be had.

THE WARREN ALTERNATING CURRENT APPARATUS, manufactured in Sandusky, Ohio, being of the inductor type and constructed on latest and most improved lines known in dynamo designing, has gained its high reputation strictly upon its meritorious points, among them being absolutely perfect electrical and mechanical construction and workmanship, highest efficiency, close regulation, no continual expense for repairs, cool, steady and noiseless running, and, last but not least, its peculiar simplicity. The Western Electrical Supply Company, of St. Louis, Mo., the general sales agents for this apparatus, will with their well known facilities continue to sustain its reputation.

MR. E. P. IRVING, secretary and treasurer of the Faries Manufacturing Co., Decatur, Ill., says they have doubled the capacity of their old factory by adding new buildings and machinery, and even now are working overtime to fill orders for their product.

THE RASTER CARBON RHEOSTAT CO., Chicago, have moved from their old factory on South Clinton to their splendid new quarters, 231 South Canal street. Their factory is newly equipped throughout.

THE ELECTRIC APPLIANCE CO. are meeting with great success in the sale of their combination fuse block and lightning arrester for telephone work. It seems to fill a large demand for an efficient device for protecting telephone apparatus, and the Electric Appliance Company have yet to hear of a single case where it has failed to operate in an entirely satisfactory manner.

MANAGER LUTHY, of the Royal Electric Co., Peoria, Ill., reports gratifying demand for single phase alternating apparatus and transformers. They recently closed a contract for several 2,000 light generators for central station use.

PACKARD TRANSFORMERS. It has always been the policy of the Packard Company to improve their material whenever opportunity offered. Their model '98 Packard Transformer represents their latest improvement in the transformer line. They

Digitized by Google

claim to have a transformer which is at the very top notch of transformer construction, and a novel plan of guaranteeing just exactly what each transformer will do. All of their claims, guarantees, etc., are fully set forward in a special circular, which can be had from the Electric Appliance Company, Chicago, Western agents for the Packard goods.

NEW ENGLAND NOTES

MESSRS. R. S. HALE and J. S. Codman, 31 Milk street, Boston, have formed a partnership for the practice of steam, electrical and other engineering, in all their branches of estimate, test, inspectsion, etc.

F. R. HARRIS, Waterbury, Conn., reports receiving good orders from several electrical concerns for special alloy wire which he draws to order. Mr. Harris manufactures on order fine brass, copper, German silver, phosphor bronze or brass wire for electrical purposes, and solicits correspondence from consumers of these goods.

ANCHOR ELECTRIC CO., Boston, are now represented in New York and the Middle Atlantic States by Mr. H. G. Issertel, formerly of the old Walker Co. He will open an office in New York City some time in November, and will carry the entire line of Anchor specialties.

RELIABLE ELECTRIC MFG. CO., Worcester, Mass., report a steadily growing demand for their entire line of telephones, transmitters, receivers, etc. Their goods, this firm claim, are superior to the majority of telephones now on the market, and are giving excellent satisfaction wherever installed. The factory has been running busy on full time. The Reliable Electric Co. will be pleased to mail catalogue with prices to any address upon application. L. M. Petterson is president, C. J. Ekstedt, treasurer, and W. E. Sundberg, general manager.

BIBBER-WHITE CO., 49 Federal street, Boston, having bought a glass plant for making glass insulators under their standard mark, "B. W. Co.," are closing out about 250,000 insulators not so marked, at low prices, including standard pony, double petticoat pony, regulars, and deep groove double petticoat. They are desirous of offering in any size lots at attractive prices, and invite inquiries and correspondence on the subject.

BERLIN IRON BRIDGE CO., East Berlin, Conn., are erecting the extension of the foundry for the Benjamin Atha & Illingworth Co., at Harrison, N. J. This extension is 51 ft. wide and 152 ft. long. The framework is of steel throughout. The sides are covered with corrugated iron on steel purlins, and are arranged for suitable doors and windows. The side columns support a 30-ton electric crane, having a span of 46 ft. The roof construction is of steel trusses and purlins arranged with openings in the roof for skylights.

NEW YORK NOTES.

THE AMERICAN ELECTRICAL & MAINTENANCE CO., of 451 Greenwich street, New York, which on Oct. 4 passed into the hands of Aldred K. Warren, president of the company, and Francis Higgins, as temporary receivers, on the application of the directors of the company, now report that their business is still on the increase. All contracts are receiving the same careful attention that they received in the past, and the receivers having had orders from the court to continue the business of the company, new contracts are being daily entered into. For the past few weeks the shops of the company have been crowded with repair work, and so satisfactory is the condition of their affairs and the outlook for business, that it is expected that within a few weeks the company will be reorganized with a larger capital, which was primarily the object of having receivers appointed.

MR. GEORGE T. HANCHETT, the well known electrical and mechanical engineer, has recently addressed himself to the inventors and manufacturers in the form of a small folder. He therein states in a most business-like manner his past experience in the shop, drawing-room and college, and solicits the patronage of all who want devices developed, designs prepared and modified, tests made, or specifications drawn up. Mr. Hanchett is certainly well fitted for such work and deserves a continuance of the confidence of his numerous friends and acquaintances in the profession. His offices are at 123 Liberty street, New York City.

SING SING, N. Y. The Berlin Iron Bridge Co., East Berlin, Conn., are erecting for the Seamless Metal Co., Sing Sing, N. Y., across the railroad tracks connecting the different parts of their plant, a steel foot bridge. The bridge consists of lattice trusses about 68 feet long, supported on steel trestles bent at either end. Underneath the bridge is a substantial trolley beam designed to carry loads from the adjoining building to the switch track of the railroad underneath the bridge.

NEW YORK CITY. The opening of the conduit trolley service on Eighth avenue was celebrated in great style last week by the West Side Improvement Association. Twenty-five special cars ran over the line, decorated, from Fourteenth street uptown, and the band of the Ninth Regiment went along. The return was marked by fireworks. The people cheered themselves hoarse over the "deadly trolley." The Metropolitan Co. has done a very rapid piece of work there.

THE WESTERN UNION COMPANY has sold its building at 16 and 18 Broad street to the New York Stock Exchange for $825,000, a price of $212 per square foot. It will not give up possession for a year or two, when the exchange will enlarge its facilities.

UTICA, N. Y. The Utica Belt Line Railroad Company are erecting on the line of their road a new riveted lattice bridge having a span of about 75 feet. It is known as the Halfway Bridge. It is a modern structure in every way for the class of work which it is called upon to do. It is to be all steel except the cross-ties on which the rails rest. The Berlin Iron Bridge Co., East Berlin, Conn., have the contract for furnishing and erecting the steel work.

CONTENTS.

EDITORIALS:
Features of Electrolysis from Railroad Work 434
Legitimate Ways of Getting Cheaper City Light 434
The Garb of the Telephone Girl 435
Insulating the Mind 435

ELECTRIC LIGHTING:
The United States Electric Lighting Company of Washington, D. C., and Its New Electrical Equipment (illustr.) ..... Nevil Monroe Hopkins. 425
Electric Light Tower Blown Down.—Shooting the Chutes in a Power House 433

EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, BOSTON:
The Exhibit of the Edison Electric Illuminating Co. (illustr.) 436
Hamilton Gas Engine and Keystone Dynamo Exhibits 437
The Moore Vacuum Tube Parlor at the Mechanics' Fair (illustr.)—Joint Exhibits of the Jandus Electric Co. and Buckeye Electric Co., of Cleveland, Ohio (illustr.) 438
Electric Light and Power Exhibit of James L. Russell(illustr.) ... 439

ELECTRIC TRANSPORTATION:
The Third Rail System as Applied to Electric Propulsion (illustr.). Lowell Mason Maxham. 439
An Electrical Survey in the Borough of Manhattan, New York City. ..... A. A. Knudson. 440
Electrolysis of Cast Iron Water Pipes at Dayton, Ohio ..... Harold P. Brown. 441
The Vehicles of the General Electric Automobile Company (illustr.). R. M. Hunter, M.E. 442
The Sprague Multiple Unit System on the Chicago South Side... E. M. Shepard. 444

NEWS AND NOTES:
Electricity in the Philadelphia Peace Jubilee (illustr.) 444
Colors for the First U. S. Volunteer Engineers (illustr.).—Space at the Paris Exposition 447

MUNICIPAL AFFAIRS:
The Municipal Gas Fiasco in Vienna 448

OBITUARY:
Camille A. Faure.—C. G. Davenport 435

SOCIETY AND CLUB NOTES:
Brooklyn Trip of the New York Electrical Society.—American Institute of Electrical Engineers.—An Electrical Theatre Party. 448

LETTERS TO THE EDITOR:
Operation of the Chicago South Side Railroad...Sargent & Lundy. 449

THE STOCK MARKET:
Irregular and Active Trade 449

TRADE NOTES AND NOVELTIES:
Crocker-Wheeler Electric Power Machinery.—A New Circuit Breaker (illustr.) 449
The Bullock Electric Mfg. Co.—The Kelsey Noiseless Ratchet Brake (illustr.) 450
St. Louis as an Electrical Center.—Formation of the Diamond Meter Co.—"Stone City" Telephones.—Advertisers' Hints.—Western Notes 451
New England Notes—New York Notes 452

Digitized by Google

The Electrical Engineer.

Vol. XXVI. NOVEMBER 10, 1898. No. 549.

TELEPHONY AND TELEGRAPHY

The Development and Present Status of Submarine Telegraphy and Cables.[1]

BY HERBERT LAWS WEBB.

MR. BRIGHT'S massive volume has all the evidence of being a labor of love, performed by one to whom his profession is the single object of his devotion. It was high time that submarine telegraphy, an industry born and raised in England and spread out over the globe during a period of fifty years almost exclusively under the British flag, should have a standard volume in the English language treating of its history and general technical features. Mr. Bright, in spite of his youth and consequent short practical experience compared with that of many other cable engineers, is thoroughly well fitted to take upon himself the task of filling this conspicuous gap in electrical literature. He was practically born a cable engineer, and was brought up, one might say, amid the aroma of the cable factory. Since starting in life for himself, some sixteen years ago, he has served on the engineering staff of the Silvertown Company, assisting during that time in the manufacture, testing, laying and repairing of many thousands of miles of cable. With this amount of actual experience and the command of the data amassed by his father, Sir Charles Bright, who won fame in cable laying in the days of its infancy, it will be acknowledged that Mr. Bright is well qualified to deal with both the practical and the historical aspects of the oldest branch of electrical engineering.

In his preface Mr. Bright states that his work was originally founded on Wünschendorff's book, "Traité de Télégraphie Sous-Marine," published in 1888. The present reviewer had occasion to point out some years ago as a curious fact that the only thorough piece of literature on submarine cable engineering was in the French language. All the more curious because up to the publication of M. Wünschendorff's excellent book the submarine cable industry was almost exclusively British, and scarcely a mile of international cable had been made out of England or laid by any but a British ship. Wünschendorff, then, necessarily took most of his material from British sources, and Bright's first idea was to turn Wünschendorff back into English, naturally adding and revising in the light of his experience and command of unpublished material. Such a plan, once begun, very naturally developed into one of far wider scope, until in the present volume we have what is practically an original production that owes little more to Wünschendorff than the inspiration which set our author to work.

Mr. Bright divides his subject under three general heads: History, Construction and Working. He disclaims dealing with the laying, repairing and testing of cables, except incidentally, and refers readers interested in those branches of the subject to other works, such as Wilkinson's "Submarine Cable Laying and Repairing." This, we think, is a pity, as the reader of a volume on submarine telegraphs could probably spare some of the matter devoted to history and working for a concise account of the operations connected with the laying and repairing of deep sea cables. In fact, we may say at the outset that the absence of a section dealing with modern cable engineering from this point of view strikes one as a serious omission. However, it is not for the reviewer to quarrel with the author for planning his work in his own way, but rather to deal with the work as it is presented to readers.

Mr. Bright devotes to Part I., History, about 200 pages; to Part II., Construction, about 300, and to Part III., Working, a trifle under 200 pages. The construction of submarine cables, therefore, very properly is the subject to which the largest section is devoted, and is that which will be of most interest to readers in this country.

[1]Based upon Submarine Telegraphs, by Charles Bright, F. R. S. E., etc., London; Crosby, Lockwood & Son, 1898; pp. xxxvi. and 702, and an index of 40 pp. Large octavo. Illus.

CABLE HISTORY.

Part I. is divided into five chapters. In the first, entitled "Early Subaqueous and Submarine Telegraphy," Mr. Bright traces the first known suggestion of submarine telegraphy to a Spaniard named Salvá, who advanced the feasibility of such a method of communication in a paper read before the Barcelona Academy of Sciences in 1795. The first actual experiments were made by Sömmering, Schilling, Sharpe and others some sixteen to eighteen years later. In 1838 and the following year actual subaqueous telegraphy was accomplished by Pasley, in England, and by O'Shaughnessy, in India. In 1840 Wheatstone exhibited complete plans for a cable across the English Channel, but it was not until ten years later that such a cable was actually laid, the experiments of Morse and Armstrong in this country and the adoption of gutta-percha as an insulator intervening between Wheatstone's suggestion of a Channel cable and the actual carrying out of the work by the famous Brett brothers, in August, 1850. The Bretts were enthusiastic promoters of submarine telegraphy, and their unbounded faith in its future is shown by their forming the "General Oceanic Telegraphic Company," which was provisionally registered in June, 1845. The first cable across the Channel demonstrated the practicability of submarine cables and then came to an untimely end at the hands of Dr. Russell's "piscator ignobile," whose ruthless knife made short work of the strange, slim rope of percha and copper which his anchor brought to the surface.

Next year an iron-armored four-conductor cable was successfully laid, and was opened for public traffic on November 13, 1851. This marks the real beginning of submarine telegraphy, and the 1851 Dover-Calais armored cable was the prototype of all the submarine cables that have since been laid. The remainder of this chapter describes the various cables between England and the Continent that rapidly followed the successful line of 1851.

It is evident that the germ of ocean telegraphy was in the minds of many men, and the moment that the submarine cable was a practical success various enterprising and far-seeing men turned their energies to the grand work of mooring the new world to the old. Mr. Bright's next chapter is entitled "The Dawn of Ocean Telegraphy," and gives a vivid picture of what seemed in those days an enterprise of fabulous ambition—the construction and laying of the first Atlantic cable. In spite of the most primitive and crude methods of manufacture, of fantastic arrangements of machinery for laying the cable, and murderous outfits of batteries and induction coils for signaling, the cable was actually laid and worked for a few days. The author's father deservedly became Sir Charles Bright (at the early age of 26) for the great feat of successfully laying the short-lived Atlantic cable of 1858.

The way had been blazed, but the early failure of the cable was a crushing blow to the devoted band of financiers and engineers who had carried on a two-years' struggle against enormous difficulties and discouragement, not the least of which was the scoffing disbelief of all those, on both sides of the Atlantic, not directly connected with the great enterprise. Atlantic cable projects were postponed for a time and the subject was meanwhile investigated scientifically. A Parliamentary committee gathered much information regarding the causes of failure and the requisites for success, as discerned by the keenest engineers who had taken up cable work. Improvements in machinery for both manufacture and laying were devised, and Thomson, Varley, Clark and Bright laid down the laws of signaling and devised the system of electrical units now the A, B, C of electrical engineers. All this is told with much detail by Mr. Bright, and reading his interesting account of the Dawn of Ocean Telegraphy one easily sees that in this period was also the dawn of electrical engineering.

Mr. Bright's next chapter, "Developments," takes the reader into the period of successful enterprise which saw the final completion of two workable Atlantic cables by Sir Samuel Canning in the Great Eastern, in 1866. After this the development of successful cable laying was active and uninterrupted by any failure of magnitude, and the chapter proceeds with the narrative of the more important cable enterprises down almost to the present

Digitized by Google

day. This chapter contains two interesting maps showing the shore ends and general connections of the North Atlantic cables on each side of the ocean. These maps and the accompanying text afford a striking illustration of the immensity of the interests that bind together the United States and Great Britain, the latter of which, as appears clearly in the excellent chart of the cables of the world at the end of the chapter, is the "central office" of the world's telegraph system.

"There are," says Mr. Bright, "altogether fifteen cables at the bottom of the North Atlantic, which are usually termed 'Atlantic cables.' Of these, the first three are absolutely dead—as well as buried; nine are in perfect condition for duplex working, and three are at the time of writing, rendering a fairly satisfactory account of themselves—with the help of occasional repairs—in simplex working." To the twelve working cables mentioned by Mr. Bright must now be added the French cable which was begun last year and completed and opened for traffic a month or so ago.

It is startling to read, in view of the present huge telegraph traffic across the Atlantic, that the first rate was $100 for 20 words and $5 for each additional word. These steep figures came down at first to $50 for 20 words, then to $25 for 10 words, and later to $7.50 for five words of five letters each. When a word rate was introduced it was put at $5 a word, and it was not until 1872 that the rate came down to $1 a word. The present rate of a shilling, or a quarter, a word was not permanently adopted until 1888.

The last chapter of Part I. is devoted to a most interesting "Miscellaneous and Commercial Resumé," in which Mr. Bright takes up the Pacific cable project in all its various aspects, discusses "Engineers and Contractors," "Telegraph Ships," "Cost and Life of a Cable," "Codes," and a variety of other subjects connected with the practical and commercial side of submarine cables. The construction of a Pacific cable, thinks Mr. Bright, will not be much longer delayed. From an engineering point of view, there are no insuperable obstacles. The greatest depth along the route is only some 700 fathoms more than the depth already successfully dealt with. Mr. Bright believes that the project will be put into execution rather through politico-commercial and imperial motives than purely commercial ones.

Mr. Bright gives the total length of telegraph cable laid as about 170,000 nautical miles, representing about fifty millions sterling, or, approximately, a capital cost of $1,500 per nautical mile of cable laid. The figures given represent the whole actual capital originally invested in the cable companies for the purposes for which they were formed, and do not represent either the actual cost of the cables themselves or the present market value of the united capital of the companies. The shares of most of the successful companies are worth a good deal more than par to-day and the total value of the world's cable system is probably nearer seventy millions than fifty.

The cost of a submarine cable to its purchaser may nowadays be roughly estimated at $750 per nautical mile, and the cost of its submersion at about half as much, making the total average cost about $1,125 per nautical mile. This is assuming average conditions all round. A large core would send the price up, as would also a large proportion of the more expensive shore-end and intermediate types of cable. The cost of laying naturally increases with the distance of the points to be joined from the place of manufacture, with the difficulties met with and with the lack of knowledge of the bottom, necessitating special surveys which usually consume much valuable time.

The life of a cable is a point on which Mr. Bright hesitates to declare himself. Various authorities place it at from thirty to forty years under good conditions. Where cables rest on the hospitable globigerina ooze they have been picked up after twenty years in as good condition as when they left the factory. Still, damage comes from all manner of sources; teredos, swordfish, sharks, whales, submarine rivers, submarine earthquakes, and other less startling phenomena of the bottom keep some forty cable repairing ships busy in all parts of the globe, and cables have to be treated in the depreciation accounts as a quick-wearing plant. Repairs sometimes cost enormously, the record case being nearly $500,000 for repairing one of the Atlantic cables a few years ago. The average rate allowed for maintenance and repairs is from $30 to $40 per nautical mile per year. Mr. Bright gives much interesting data on these points and on the earnings of cables, but we might fill pages with quotations. The total traffic of the world's cable system he estimates at about 6,000,000 messages a year.

Part I. concludes with an Appendix devoted to the Postoffice submarine cables connecting England with Ireland and the Continent, and another on Submarine Telephony, describing the London-Paris line. An interesting description, with complete drawings, is given of the Postoffice cable steamer "Monarch." An excellent chart of the world showing the cables both laid and projected is inserted at the end of this section of the book. It is reproduced herewith.

THE CONSTRUCTION OF CABLES.

Part II., dealing with construction of cables, is divided into five chapters covering: The Conductor, The Insulating Envelope, Jointing, Mechanical Protection and Strength, The Completed Cable, and has appendices of wire tables and complete specifications for cables. In the first chapter Mr. Bright traces the history of copper as a conductor for electric cables and gives much valuable data regarding the early experiments with copper and cable conductors in particular. The adoption of the stranded conductor was settled in the early days of the cable industry. The steady rise in the size of submarine cable conductors, to meet the demand for increased speed in signaling, is accentuated in the specifications for the recent "Anglo" and "Commercial" cables. The first Atlantic cable had a conductor weighing 107 pounds per knot, insulated with gutta-percha weighing 261 pounds per knot, and this was the heaviest core so far made. As a result of scientific research, the specification for the 1865 cable called for a conductor weighing 300 pounds per knot, insulated with gutta-percha weighing 400 pounds per knot. The conductivity of the copper was to be at least 85 per cent. The core of the latest Commercial cable is made up of 500 pounds of copper and 320 pounds of gutta-percha per knot, and that of the latest "Anglo" of 650 pounds of copper and 400 pounds of gutta-percha per knot. The last mentioned conductor is half as large again as the hard-drawn copper wires on the telephone circuits between New York and Chicago. It is to be borne in mind, too, that whereas the copper used for the 1865 300-pound conductor had a conductivity of only 85 per cent., the 650-pound conductor of 1894 has a conductivity of 100 per cent. or over, so the increased electrical efficiency is very much greater than appears by a mere comparison of the weights. Mr. Bright gives an extremely interesting discussion of the electrical, mechanical and commercial conditions that govern the design of submarine cable cores. The description of handling the copper wire in the factory and laying it up into the stranded conductor is most complete, and is well illustrated by drawings of the machinery employed.

In his chapter on The Insulating Envelope, Mr. Bright traces the introduction of gutta-percha back to 1843, but it was not until several years later that its applicability to the insulation of electric wires was recognized by Werner Siemens and by Faraday. Siemens claimed priority and seems actually to have made the first die-covering machine for applying the gutta-percha to the wire, in 1847. After that date experiment and progress were rapid, and gutta-percha promptly became the recognized insulator for submarine cables. The supply of the gum is unfortunately limited and tends to diminish. The price of the raw material was once as low as 9d. (18 cents) a pound in England. It now ranges from 4s. 6d. to 7s. ($1.10 to $1.75), and has been as high as $2.50 a pound. Mr. Bright gives a very full account of the different varieties of gutta, the sources of supply and the methods of collecting. Then follows a detailed account of the physical properties of the material, the methods of cleansing and manufacture, the electrical properties and the effect of the pressure of the water on the insulator of a submerged cable. The description of the various cleansing and masticating processes is done with much detail, and is thoroughly illustrated by drawings of the machines used; one only wonders that when the gutta has been through them all it has strength enough left to cling to anything. In this chapter the reader gets a very thorough picture of the manufacture and treatment of "core," the application of the gutta-percha to the conductor, with all the ingenious machinery involved, and the testing of the completed article. The requirements of different classes of core are all very fully gone into. At the end of the chapter Mr. Bright makes a quite unnecessary apology for its length, pointing out that the subject is of importance, as the cost of the gutta-percha dielectric forms so large a proportion of the total cost of a cable. The chapter is replete with most valuable and interesting data and needs no apology, especially, as Mr. Bright points out, because the subject has not been dealt with fully in any previous treatise. Insulated wire manufacturers in this country should possess Mr. Bright's book for this chapter alone.

Digitized by Google

In dealing with india-rubber Mr. Bright describes its origin and early history in his usual painstaking way and discusses its use for submarine cable cores, for which purpose the well known Hooper's core was specially designed. In tropical climates vulcanized india-rubber has a better chance of existence than gutta-percha; it stands the temperature better and the teredo and other submarine borers do not seem to fancy it as much as they do gutta-percha. It also has a lower specific electrostatic capacity and a higher specific resistance. Yet in spite of these advantages vulcanized rubber has not displaced gutta-percha as an insulator for submarine cables, and, in spite of the great improvement in its manufacture, is not likely to do so until gutta-percha becomes so scarce that cable makers will be forced in despair to fall back on the best substitute. The reason is, of course, that vulcanized rubber is not so reliable as gutta-percha. Engineers know exactly how gutta-percha will behave under given conditions, but with vulcanized rubber they can never prophecy with any feeling of certainty just what will happen. All this is set forth very fully in Mr. Bright's discussion of the relative merits of gutta-percha and vulcanized rubber for submarine cable cores.

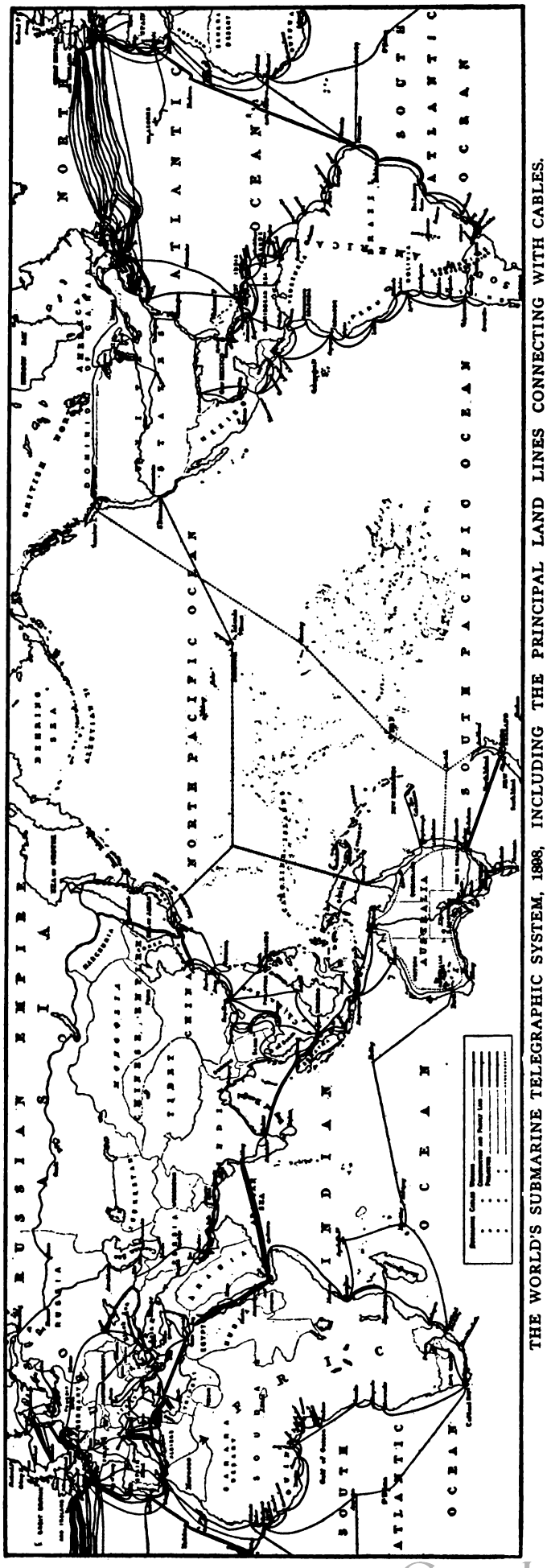
Following a short description of the various substitutes for gutta-percha and rubber that have been proposed and are in actual use, comes a very excellent chapter on "Jointing," in which the operations of jointing gutta-percha and vulcanized rubber cores are minutely described and very thoroughly illustrated. This is a very important part of any cable-laying operations, even where cables are laid in pipes under city streets and are accessible at manholes placed a couple of hundred feet apart. But when the joint has to be dropped to the bottom of the ocean, a couple of miles below the surface and hundreds of miles from the shore, it and its maker become of paramount importance. A drop of perspiration on the hand of the jointer, or an awkward manœuvre with the lamp or tooling iron, may cost the owners of the cable many thousands of pounds. For these reasons early writers on jointing submarine cable cores used to write in large capitals; Mr. Bright, who stops short in his demands on the printer at whole sentences in large capitals, enforces the importance of the subject by plentiful repetition and an extra liberal use of dashes, parentheses, asterisks and daggers.

The main trouble about writing on jointing is that it is work which, as Mr. Bright points out, cannot be learned from a book. Another annoying feature of jointing submarine cables is that the joint for a final splice cannot be tested on the ship. A solemn performance is always gone through for the sake of the moral effect on the jointer; but the test actually reveals nothing, and when the bight is lowered over the bows it is accompanied by an unspoken prayer that the jointer has stood up to his record and turned out a perfect job.

In his chapter on "Mechanical Protection and Strength," Mr. Bright gives an admirable account of the various coverings by which the core has to be surrounded to become a completed cable, and of the processes and machinery by which these coverings are applied. Those not familiar with deep sea cables will find this chapter something of a revelation. The varied conditions under which cables have to exist in different parts of the world have caused the mechanical portion of the cable to become a very much more complex affair than is generally imagined. The evolution of the mechanical protection given to the precious core, and the protection of the protection, is very interestingly traced in this chapter.

First, in many parts of the world the core has to be protected against the greed or mischievous curiosity of submarine borers. Of these there are several varieties. The teredo navalis is mainly met with in tropical waters, but he has a northern cousin, Limnoria tenebrans or Limnoria lignorum, who carries on researches in colder waters, such as those of the English Channel. To keep out these costly insects the core has to be sheathed with metal tape, which is put on over a bedding of cotton tape. The metal tape is usually of brass, though it is interesting to learn that in the recent Amazon River cable, Messrs. Siemens Brothers covered the core with a lead tubing. Such a covering has the advantage that, besides being teredo-proof, it forms an air-tight covering for the gutta-percha, preserving it from decay in dry soil. This would be an important point even if it only applied to the beach portion of a shore-end, where faults often occur, but such cable would come in very well for the connections between the cable huts and the town offices which are now often made by ordinary deep sea cable laid in trenches.

After the core protection naturally comes the inner serving of hemp or jute. This part of the cable serves the double pur-



THE WORLD'S SUBMARINE TELEGRAPHIC SYSTEM, 1898, INCLUDING THE PRINCIPAL LAND LINES CONNECTING WITH CABLES.

Digitized by Google

pose of forming a cushion between the sheathing wires and the core, and of giving sufficient diameter to the cylinder to contain the number of iron wires that will assure the requisite mechanical strength to the completed cable. The properties of jute, now usually employed, the preservative processes and the methods of applying the serving are fully described, and illustrated by drawings of machinery.

In approaching the subject of sheathing, Mr. Bright, who indulges here in an extra allowance of footnotes, gives an interesting discussion of the various styles of sheathing for different situations and different types of cable. In general, it may be said that shallow water cables need sheathing that will resist abrasion, and deep water cables need sheathing of great tensile strength, to stand the strain of paying-out and of picking-up for repairs. The size of sheathing wires varies from .07 inch to .4 inch, and the number from ten to about thirty-six. Deep sea cable is sheathed with Bessemer or homogeneous wire having a breaking strain of over 80 tons to the square inch. For intermediate and shore-end types this great tensile strength is not required, and softer metal of less breaking strain is used. Shore-end cable usually has two sets of sheathing wires, being made up of the ordinary deep sea type, covered with a second serving of jute surrounded by a sheathing of very stout iron wires; this outer heavy sheathing is sometimes composed of strands of three wires instead of single wires. Shore-end cable is built to withstand the wearing action of movement caused by the tide, rocks, anchors, trawls and other disturbing elements incident to shallow waters. The difference between the shore-end and the deep-sea type is apparent when it is considered that the latter usually weighs from 1 ton to 1¾ tons per nautical mile, whereas the former weighs from 20 to 27 tons per nautical mile. Cable makers in this country, who deal exclusively in cables to be laid in shallow waters, will be particularly interested in Mr. Bright's discussion of this branch of cable making. In this chapter he deals very completely with the whole subject of sheathing water cables, from the various tests applied to the wire, through the entire process of building up this very important part of the cable. The several methods of protecting the sheathing wires from decay are discussed in full and all the machinery used for the sheathing of cables is described and illustrated in detail. A similar thorough description of the outer covering applied to the cable carries us through to the completed cable, which is reached in this chapter.

As regards the output of finished cable, Mr. Bright informs us that the larger factories have ten to twelve cable machines, for all types. Each of these machines could, under pressure, turn out from five to six nautical miles (30,400 to 36,500 feet) in a day. The average output, under ordinary circumstances, is about 30 nautical miles a working day. In the case of the 1894 Commercial cable, work was carried on day and night, and cable was turned out at the rate of 50 to 55 nautical miles every 24 hours. Night work on cable making is not encouraged, however, owing to the bad light for the work and also because it involves a shift of "hands" of less experience than that of the regular working force.

This section of the book, which will repay careful study by every one interested in the management of a cable factory, even when the product is not the ocean type of cable, concludes with a chapter on the completed cable. This chapter deals with the mechanical requirements and tests of the completed cable, and various data relating to the weight, specific gravity and strength of various types of cable. To complete the information under the head of the completed cable, two specifications are appended to this section of the book, one to illustrate the representative deep sea cable and the other the representative shallow water cable. The first refers to the 1894 Anglo-American cable and the second to the four-conductor cable laid by Siemens Brothers for the British Postoffice in 1891 between the coast of Norfolk and Borkum Island, Germany. The deep sea section of the 1894 "Anglo" is laid in depths of 2,600 fathoms, whereas the maximum depth in the North Sea, which the Anglo-German cable crosses, is only 20 fathoms.

Mr. Bright concludes this portion of his subject by a short discussion of "Light Cables," i. e., cables in which iron sheathing wires play a subordinate part or no part at all in the mechanical make-up of the cable, a hemp covering or sheathing taking partially or entirely the place of the iron. Mr. Bright, as usual, goes carefully and conscientiously into the historical and theoretical data regarding light cables, but very rightly treats them as either curiosities or ingenious attempts to out-manœuvre natural conditions and requirements that must assert themselves in the long run. The non-armored cable is a lost cause as far as any practical use on a large scale is concerned.

THE WORKING OF SUBMARINE CABLES.

The third part of the book, on "The Working of Submarine Telegraphs," contains a quantity of useful and interesting matter and is written in a more straightforward style, with fewer interpolations and footnotes than occur in the previous sections. Probably Mr. Bright gained by practice in the progress of his task, for certainly this section, while the most technical of the three, is the easiest to read. It is divided into five chapters: "Theory of the Transmission of Signals through Cables," "Signaling Apparatus," "Duplex Telegraphy," "Machine Transmission" and "Recent Developments." The first chapter contains a mathematical discussion on the theory of the propagation of signals through long cables, and explains in a very thorough and detailed way the working of cables by the use of "curbed" signals and of condensers. This is followed by an extremely interesting section on the speed of signaling. On the speed of a cable depends its earning capacity, so this subject is a vital one. In Mr. Bright's dealing with it one can follow the progress of the science of long distance telegraphy from the early days, back in the fifties, when the luminous-minded Thomsons and Varleys evolved its laws, up to the present time, when machine transmitters pump messages through a thousand tons of copper at a speed that would tax the ability of a dozen of the cables of thirty odd years ago. The speed of signaling, or, rather, the carrying capacity of the cable, has been increased in every direction. By increasing the copper the fitness of the cable for fast working has been increased. The standard core for cables of under 1,000 miles is 107 pounds of copper per nautical mile. The 1865 Atlantic cable had 300 pounds per nautical mile of copper of low conductivity. Later Atlantic cables had 400 pounds of copper of high conductivity, and the 1894 "Anglo" cable—the champion cable of the world—has 650 pounds of pure copper per nautical mile, practically a ton of copper to every three miles! The average speed of hand transmission with expert operators is about 20 words per minute. By efficient duplexing the cable carries nearly double the amount of traffic. With machine transmission the 1894 "Anglo" cable is worked at from 45 to 50 words a minute each way. The working speed of the early Atlantic cables was from eight to ten words a minute, so that large cores, duplexing and machine transmission, enable one cable to-day to carry traffic that would have swamped eight or ten thirty years ago. A good many of the world's cables can carry all the traffic they get without recourse to automatic transmission or even to duplexing, and with very few exceptions the high pressure that demands the extreme speed mentioned above is peculiar to the Atlantic cables.

In dealing with signaling apparatus Mr. Bright describes and illustrates in detail the various instruments used in cable telegraphy, such as the Brown-Allan relay, the mirror and the siphon recorder. The last is, of course, the most important, as it is used on all cables of over a few hundred miles and has almost entirely displaced the mirror except on cables where the traffic is very light. The numerous improvements that have been made in the recorder since its invention by Lord Kelvin in 1867 are fully described and illustrated. About the most important of these was the vibrator, invented by Mr. G. F. Pescod, when working one of the Central and South American cables in 1884. Mr. Pescod discovered that the recorder signals were enlarged and better defined when the siphon was in a state of vibration. He promptly adopted means for keeping the siphon in continual vibration and this important invention has been adopted, with individual modifications, all over the world. This chapter is replete with well executed drawings and diagrams of the working parts and connections of siphon recorder installations.

The next chapter gives a fascinating account of the development of duplex telegraphy as applied to long cables. The early history of duplexing is traced back to Dr. Gintl, of Vienna, who apparently first conceived the idea in 1853. Siemens had a differential duplex at work in 1854. In 1858 Farmer suggested the Wheatstone Bridge duplex, but the differential system was practically alone in the field and applied to land lines only, until J. B. Stearns, in 1872, devised a duplex involving the use of condensers in the artificial line to balance the capacity of the cable. The artificial line containing distributed capacity and resistance had been invented by Varley in 1862, but to Mr. Stearns is due the practical application of it to duplexing. The next important

Digitized by Google

development was in 1875, when Herbert Taylor and Alexander Muirhead invented what is known as the Muirhead artificial cable, which imitates the electrical properties of the real cable almost to perfection. "The result of this device," says Mr. Bright, "was that duplex cable working from that time became possible in practice; and the system has since been applied successively and successfully to almost all the cables now in operation at the bottom of the sea, thereby increasing their capacity by some 90 per cent." The development of the Muirhead and Taylor duplex system is traced very thoroughly in the succeeding pages, with the usual liberal allowance of theoretical and working diagrams. The most important improvements were the introduction of the "double block" system, or the substitution of condensers for resistances in the arms of the bridge, and the introduction of a low resistance rheostat at the apex of the bridge. This last feature facilitates final and accurate adjustment of the whole system. The "double block" system has almost entirely superseded other duplex methods. About 75,000 nautical miles of cable have been duplexed by the Muirhead system.

The chapter on Automatic or Machine Transmission deals with a branch of telegraphy that has recently assumed great importance on the Atlantic lines, where the nature of the traffic demands the acme of speed and accuracy. Business men in London have long ago come to consider New York, telegraphically, as forming part of the British inland telegraph system, so extraordinarily rapid a service having been developed by sharp competition for telegraph traffic between the two most active business centres in the world. Machine transmission has enabled the companies to cope with a rapidly growing traffic and maintain the high standard of service which they had themselves set and which their customers hold them to by strenuous complaints at delays that in an inland service would pass unnoticed.

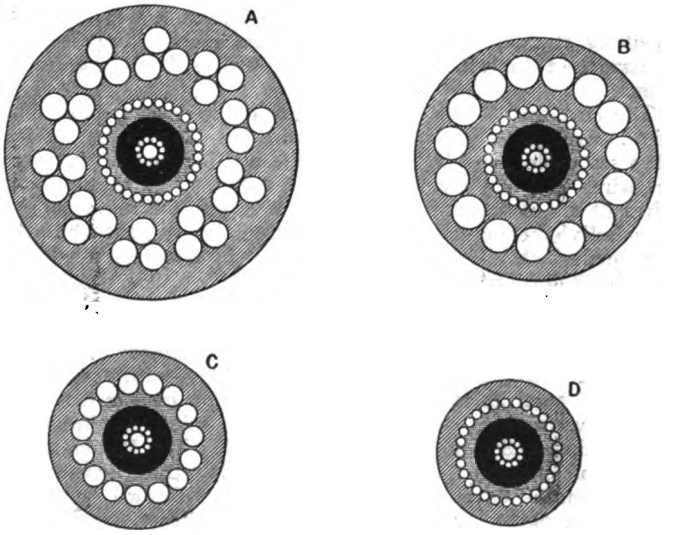
The first application of machine transmission to cables was made in 1879 by Messrs. Belz and Brahic, who modified the Wheatstone automatic transmitter to work a Froment relay as a current reverser. The Belz-Brahic system was adopted by the French Government for working the Marseilles-Algiers cables. These cables are about 500 nautical miles long, and have the standard core of 107 pounds copper and 140 pounds gutta-percha per nautical mile. The working speed of the automatic system is about 1,800 words per hour simplex and about 3,500 duplex. In 1888 Mr. Herbert Taylor, who has been one of the most ingenious and distinguished workers in submarine telegraphy although his name has generally been eclipsed by the more sonorous one of Muirhead, designed an automatic transmitter for the Anglo-American Telegraph Company, the pioneers of Atlantic telegraphy. This instrument is on the Wheatstone principle, adapted to send the cable code of signals. It has received successive improvements at Mr. Taylor's hands and is to-day a simple and efficient mechanism whose speed is limited only by the electrical constants of the line. On the 1894 Anglo cable it has achieved a speed, sending press messages, of fifty five-letter words a minute. Mr. Delany's ingenious automatic transmitter, which dispenses altogether with the Wheatstone rocking beam, substituting steel brush contacts between which the perforated slip is drawn, is next described and illustrated. Excellent results have been obtained with the Delany transmitter on various of the Atlantic cables, the speed on the 1894 "Anglo" running up to 251 letters per minute, or a trifle over the record of the Taylor transmitter. The Taylor and Dearlove automatic curb transmitter, the Wilmot, Cuttriss, Muirhead and Saunders automatic transmitters and some others are described and illustrated. The advantages of machine transmission on submarine cables are summed up by Mr. Bright somewhat as follows. The signaling speed is limited only by what the core will carry and the receiver record. The average speed of hand sending on long cables is not much over 20 words a minute, although the very best operators are capable of running up to 30 or 35 for short spells. The siphon recorder has a possible speed to-day of about 100 words a minute. So the problem for the cable owners and their engineers is to determine how much it is worth while to spend on core to attain a signaling speed of anything up to 100 words per minute. This will naturally depend on the traffic. Other than increase of speed the advantages of machine transmission are greater uniformity and better definition of signals and greater freedom from errors by the elimination of the personal equation at one end of the line. Machine transmission on cables is principally confined at present to the Atlantic cables and some of the longer and busier sections of the Eastern Company's system.

Mr. Bright's final chapter is entitled "Recent Developments," and contains a discussion of various inventions for the improvement of cable telegraphy. Among these are Delany's cable relay and sounder, Muirhead's Universal Transmitter, adapted for both Morse and recorder working, and the work of Cuttriss, Raymond-Barker, Taylor and Dearlove in cable relays. Mr. Bright does not believe in the practicability of a relay at the end of a long cable, owing to the inherent difficulty of the changing zero. An interesting discussion of "leak" and compensating cables follows, describing the methods designed by various workers, Taylor, Dearlove, Silvanus Thompson and Preece, to overcome the retardation of long cables. A short account of Smith and Granville's multiple core air space cable is given, with figures and illustrations. This cable, with a total weight for the four conductors of 940 pounds of copper and 940 pounds of gutta-percha per nautical mile, gives a KR of 1.012 per nautical mile, as against the KR 2.0719 per nautical mile of the London-Paris telephone cable with 640 pounds of copper and 1,200 pounds of gutta-percha per nautical mile for the four conductors. A short length of this air space submarine cable has been successfully laid in the Solent and gives excellent electrical results. To be strictly up to date, the book concludes with a short account of Marconi's experiments in wireless telegraphy.

Taking Mr. Bright's book as a whole, it bears all the evidence of a remarkable amount of painstaking labor. Mr. Bright seems to have read and studied about everything that has been written and printed on the subject of submarine cables, and on this fairly voluminous mass of matter—much of it buried in patent specifications and transactions of engineering societies—he has brought his own experience and judgment as a cable engineer to bear with good effect. He has produced a book which certainly ought to be in every electrical library as a book of reference, and which ought to be read and studied for its practical information by every manufacturer and user of insulated wires and cables. To telegraph men the world over it goes without saying that "Submarine Telegraphs" will be a work of fascinating interest from start to finish.

The New French Atlantic Cable.

As has been previously announced in these columns, the new "French" transatlantic cable connecting Brest on the coast of France with Cape Cod, our Massachusetts station, was formally opened on August 17 in the presence of the acting Secretary of State of the U. S., Mons. Cambon, French Minister, and the officials of the French Embassy at Washington, when friendly greetings and congratulatory messages were exchanged between Presidents McKinley and Faure. The cable was man-



CROSS-SECTIONS OF THE "CAPE COD-BREST" SUBMARINE CABLE.

ufactured and laid by the Société Industrielle des Telephones, and is owned by the Compagnie Française des Cables Télégraphiques. The ship François-Arago had been fitted up with the necessary appliances to do the laying of this cable, which is by far the longest submarine cable in existence, it being 3,165 nautical miles in length. It is also remarkable in having a heavier core than any other section, the next heaviest being the Anglo-American company's 1894 cable, the length of which

Digitized by Google

is 1,845 miles. In view of these facts, which make this cable of special importance, the following figures, which have been kindly furnished to us by the French Telegraphic Cable Company, will be of interest:

The core of the cable consists of strands of copper wire covered with an insulating covering of gutta-percha. The conductor consists of a strand of 13 copper wires weighing 660 pounds per nautical mile, of 6,074 feet, and composed of a central wire of 0.12-inch in diameter surrounded by 12 joined wires wound in helix form.

The resistance of the conductor thus formed does not exceed 1.850 ohm per nautical mile, at a temperature of 24 degrees centigrade. The dielectric weighing 400 pounds per nautical mile is formed of three layers of gutta-percha alternating with as many layers of Chatterton compound, the first of these being applied directly on the conductor so as to fill up the interstices left by the wires.

The electrical resistance of the dielectric thus formed is not less than 250 megohms nor more than 1,500 megohms per nautical mile at a temperature of 24 degrees centigrade.

The total weight of the core is 1,056 pounds per nautical mile for the copper and 400 pounds for the gutta-percha. The electrostatic capacity of the cable is 0.50 microfarad per nautical mile.

The sending speed of this new cable, which, as above stated, is a trifle less than twice the length of the Anglo-American cable, is about 90 letters per minute simplex. It has not been duplexed as yet and when this is done it will be interesting to compare the relative speeds of transmission of these two cables. These figures and those regarding the earning power on capital cost will, we trust, soon be forthcoming. From the data on hand, however, it appears that for the same length, the speed of the French cable should exceed that of the English cable by one per cent.

The core is covered with 2 layers of hemp or of tanned jute applied wet and wound in opposite directions so as to protect it from the wires of the armature. The protecting envelope of the cables is composed of jointed metallic wires of different kinds, diameters and number, in accordance with the types shown in the figure. The envelope of the deep sea cable, type D, is composed of 24 steel galvanized wires of 0.067 of an inch in diameter, and of medium resistance, after galvanization, wound in a helix, the minimum strain before breaking being 160,000 pounds per square inch. The breaking resistance of the cable thus formed is not less than 11.451 metric tons. Another deep sea portion is very similar, except that the breaking strain is 14.314 metric tons. The envelope of the intermediary cable marked C is formed of 15 galvanized iron wires of 0.13 of an inch in diameter, after galvanization, wound in a helix, minimum breaking strain 52,800 pounds per square inch. The breaking resistance of the cable thus formed, is not less than 9.374 metric tons.

The envelope of the coast cable marked B is composed first of an envelope of galvanized iron wires, similar to that of the deep sea cable, type D, as regards the number and diameter of the wires, and of a second envelope made of 15 galvanized iron wires of 0.2 of an inch in diameter, after galvanization, wound in a helix, the minimum breaking strain being 52,800 pounds per square inch. The breaking resistance of the cable thus constituted is not less than 25.352 metric tons.

The envelope of the shore end cable marked A is composed of first an envelope of galvanized iron wires, similar to that of the deep sea cable, type D, with regard to the number and diameter of the wires, and then of a second envelope formed of ten strands of 3 galvanized iron wires of 0.16 of an inch in diameter after galvanization, wound in a helix, the minimum breaking strain being 52,800 pounds per square inch. The breaking resistance of the cable thus formed is not less than 31.915 metric tons.

The metallic envelope is finally covered with two layers of rough jute twine, or of two linen tapes, Johnson & Phillips system, steeped with bituminous and silicious composition, according to professional rules.

The exterior diameter of each type thus covered is not more than:

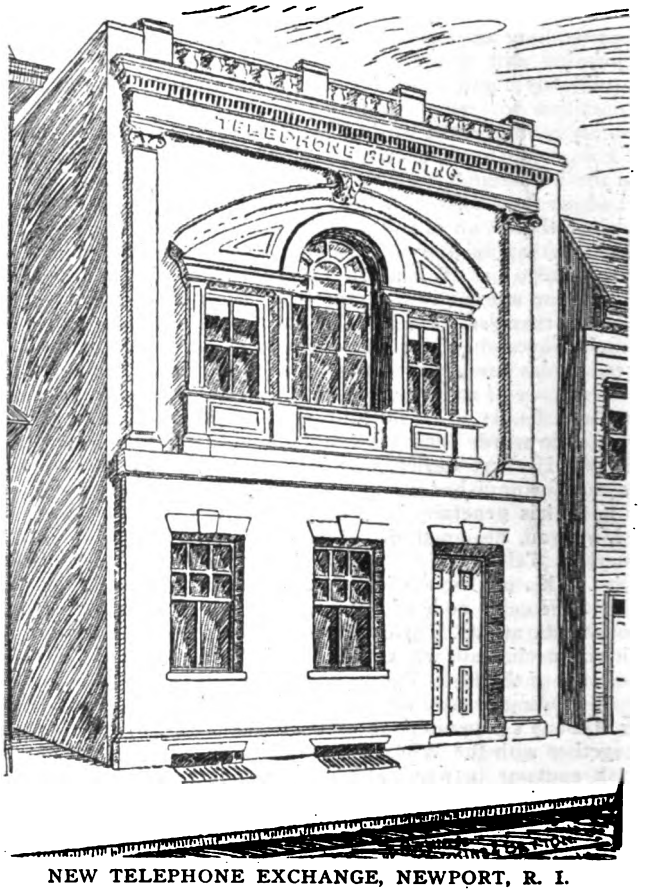
For the deep sea cable	1.067	inches.
For the intermediary cable	1.279	"
For the coast cable	1.891	"
For the shore end cable	2.167	"

The tests of insulation, of resistance and of capacity which were made after the completion of this cable, and which lasted several days, were of the most satisfactory kind. This cable, which is laid further South than all other transatlantic cables, is considerably less affected by earth currents, then they, and this on account of its distance from the Newfoundland shores.

New Telephone Exchange at Newport, R. I.

THE wealth, importance and social activity of Newport, Rhode Island, have always made a good telephone service necessary and have done much to develop the system in that city. For some time past the Bell lessees in that territory, the Providence Telephone Company, have been operating an exchange in the Gas Building, but during the current year the construction of a big exchange has been pushed forward, and we are now able, through the courtesy of the Newport "Daily News" to show a good picture of this new exchange. As will be noted, the service now has a building all to itself.

The new building contains all the latest and best electrical appliances for telephone service. While the structure is a handsome one nothing has been allowed to detract from its usefulness in order to add to its beauty merely. Passing through the front entrance on Spring street one finds himself in a small



NEW TELEPHONE EXCHANGE, NEWPORT, R. I.

vestibule which admits to the general office on the first floor. This room is neatly furnished in oak and has a counter of the same material for the clerk in attendance. At one side are three sound-proof telephone booths for local or long distance connections, making a well furnished pay station. A telephone has been installed at the main counter where the clerk can call the operating room to make the proper connections for the occupants of the booths. Each booth is equipped with the latest improved telephone desk. Behind the counter is a door opening into the private office of the superintendent, Mr. Wright, and this room, also finished in oak, is furnished handsomely in the same material.

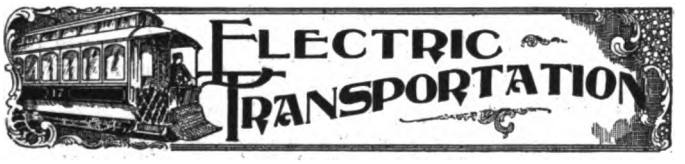
The cables enter the basement from Spring street. At present there are but four cables run in, but there are facilities for twelve when the business warrants their use. Each cable contains 240 wires. These cables are opened in the basement and the wires carried to the distributing frame on the first floor in the rear of the general office. From this frame the wires continue upwards and are connected with the switchboard on the second floor.

Digitized by Google

In the test room on the first floor where the distributing frame has been placed is also a power plant of three small Crocker-Wheeler dynamos, one of them connected with a storage battery consisting of four groups of cells which supply the transmitter and the self-restoring drops on the switchboard. In this room all breaks or accidents to the wires are located, the operators reporting any faulty connections to the man on duty there. This system will save much time and trouble in hunting up breaks. The building is lighted by electricity and heated by steam.

On the second floor is the operating room containing a switchboard of the latest design, capable of accommodating nine operators and at present equipped for six. The switchboard is of Western Electric design. Along the face of the board are call numbers of subscribers on self-restoring drops, and a row of multiplying jacks, while on the table are the answering and connecting plugs, listening keys and buttons for call bells. The wires to connect the switchboard pass up from the distributing frame on the lower floor. The board is of the new "lamp" type. On the face of the switchboard before each operator is a small electric lamp to attract the attention of the operator when a call number drops. All parts of the board are dust proof, and it is adapted to either ground or metallic circuits. Following the removal, the system is to be changed from the present grounded to a metallic one. The switchboard is equipped for four hundred wires and has a capacity of three thousand. This room is lighted by a skylight in the roof and due provision is made as usual for the comfort of the operators.

Ground was broken for the construction of this building in October, 1897. The architects are Perkins and Betton, of Boston, and the builders Friend and Maguire, of Newport. The underground cables which enter the building were begun in March, 1897, and since that time three miles of trench have been constructed. About 85 miles of overhead wires were removed to be replaced by the underground system and about three miles of overhead cable were taken down. As soon as the new building is working smoothly there will be several more miles of wire removed. Mr. Harry C. Christian has had charge of installing the electrical machinery in the new building.



Rails—Their Construction from a Scientific Standpoint.[1]

BY A. T. MOXHAM.

MANY years ago the London & North Western Railway Company, of England, reached the conclusion that what was known as a "soft" or low carbon rail gave the longest life, and its conclusions were honestly based upon what appeared to be clear-cut, practical experience. This was reinforced shortly afterwards by Professor Dudley, at that time acting for the Pennsylvania Railroad Company, who gave the result of tests that on the face of them were to be relied upon. His paper was an able contribution to the knowledge of the day. His general conclusions led to the "soft" rail, and he went further and endeavored to determine by comparison a factor for each special chemical ingredient. His conclusions created something akin to a sensation, and they were bitterly opposed by the steel experts of the time. Perhaps the fact that the steel manufacturer of that day was not sufficiently master of the situation to economically produce the ideal rail, according to Dr. Dudley's standard, may account for a good deal of the opposition. During the same period, however, notwithstanding these deductions, the tendency of the rail called for in actual practice was always to higher carbon. The writer himself during this interval was a supporter of the "soft" or ductile steel for rails, and even to this day, and in view of what is to follow, it is to the writer's mind a questionable thing whether a steel of great ductility and only of moderate hardness is not the steel for steam railroad purposes. It must be remembered, however, that the problem of wear upon a steam railroad is a very different thing from that of wear upon a street railroad. The rail in steam railroad use presents a clean head, because the rail is not buried. It has to oppose principally a rolling friction, for the number of times per mile that steam railroad trains are stopped is very few, taking a general average. The street rail, on the other hand, has not only to meet this rolling friction, but has to contend with the grit from the surrounding roadbed, and with stops every few feet. Not only are the stops incomparably more frequent, but they are again multiplied into a greater number of units, as many individual cars are the rule on street railroads as against the occasional train of the steam road.

Being unable to reach positive conclusions from the published authorities and from personal contact with the steel experts of the country, or even from our own experience, it was determined to conduct experiments to this end.

The experiments have lasted for three years. The first endeavor was to take broadly a "soft" steel and a "hard" steel for the rails to be tested, securing the difference by carbon alone, leaving all other ingredients as nearly as possible the same. The experiment with these was started in October, '95, and has been continuous ever since. In June, 1896, additional rails were added to the experiment, supplied by the West End Street Railway Company, of Boston, who at that time had determined (with wisdom as will be seen subsequently) upon a steel both hard and ductile. The conclusions, therefore, are based upon what may be described as soft steel, hard steel, and steel both hard and ductile.

The rails (some 33 in all) were laid in the South Eighth street tracks of the Nassau Electric Railroad, of Brooklyn. They were laid continuously, so that the same car is obliged to pass over every rail, and therefore each rail is subject to the same wear, and the wear on the head only is considered. Street traffic is ignored. The point was selected as one that would give great wear in a short time in order to reach early conclusions, as the cars pass this point at extremely short intervals.

There were seventeen rails of low carbon (viz: averaging .28); fourteen rails containing high carbon (viz: .59), and two were West End rails. The least wear shown was in the West End rail, the hard rail follows a good second, while the greatest wear is shown in the soft rail.

	Soft.	Hard.	West End.
Carbon	.280	.59	.570
Silicon	.026	.056	.234
Phosphorus	.106	.097	.050
Sulphur	.066	.059	.078
Manganese	.790	.83	.980
	1.268	1.632	1.912
Iron	98.732	98.368	98.088
	100.	100.	100.
Special grade	7.855	7.841	7.825
Based on iron only, ignoring the metalloids	7.956	7.971	7.977

The average monthly wear amounted to .0007 for the West End rail, .0012 for the hard rail and .0017 for the soft rail. The results of the experiments are conclusive on this point. We will, therefore, in the subsequent analysis, start with this as a fact. We will refer first to the physical test, and take last the question of chemical compositions. In the physical tests we will take first:

A. Specific gravity. The specific gravity of the iron in the different rails stands as follows:

Soft rail	.7956
Hard rail	.7971
West End rail	.7977

It is interesting to note the very close relations of this arbitrary specific gravity to the relative wear as shown in the test. This is not a point to be ignored, because it is an exponent of the mechanical treatment, and it explains consistently in this, as in many other cases, why the material with apparently (but not really) the lightest specific gravity will show the best results in use. The analysis shows that what is needed, as may be expected, is the densest steel.

Taking now B., Tension and Compression Tests. In the tension tests the ultimate strength stood as follows:

Soft rail	75,860 lbs.
Hard rail	118,100 lbs.
West End rail	120,380 lbs.

[1]Paper read before the N. Y. State St. Ry. Assoc., Sept., 1898. Abstract.

Digitized by Google

Closely following the determined wear. In elastic limit the relation is:

Soft rail	45,730 lbs.
Hard rail	62,500 lbs.
West End rail	53,160 lbs.

This, it will be noted, does not follow the rule of wear, and in this is a lesson, the indication being that, having secured a given amount of hardness, and consequently of strength, that the more ductile the rail the better the wear. In the compression tests the same lesson is learned. The elastic limit of compression standing at:

Soft rail	35,000
Hard rail	50,300
West End rail	47,100

At a glance it would appear that the rail compressed the least would wear the longest, but where difference in compression is indicative of greater elasticity without a sacrifice of ultimate strength, it is within reason to the good.

We will deal now with chemical composition, comparing first the soft and hard rails.

As stated before, the only variation in chemical composition which we need look at in this comparison is the carbon, for while there is a slight variation between the two silicons in the given rails, the total percentage of silicon in either is not a factor, and can therefore be ignored. The greater durability of the hard rail as compared with the soft rail speaks for the higher carbon, and it may here be noted that so far as the higher carbon is concerned it involves no higher cost to the street railway men.

We all know that we can use a street rail until at least one-half inch is worn away from the head, or .5 inch. On this basis, and taking the average wear of the different rails as shown in the test, it would take

25 years to wear away ½ inch with the soft rail;
35 years to wear away ½ inch with the hard rail;
60 years to wear away ½ inch with the West End rail,

and this is the case of a road which represents not average, but excessive wear, the rails in question having borne the wear of heavily loaded cars running on an average of 580 per hour for 20 hours per day, during the time of the experiments, or a two-minute headway. This means during the busy part of the day less than one-half minute headway and during the night hours a wider interval. Taking the ordinary line its average headway is less than this, consequently the theoretical wear would be greater. Now, all of us who are interested in electric roads and have used girder rails are aware of the fact that we do not get anything like this wear, and this being the case we have got to look to something else besides quality of steel. I think we all know what the cause is, and I am glad to again emphasize it because it discloses a great evil we are still suffering from without realizing it to the extent we should—the defect is in the joints.

The conclusions we are led to seem to me to be as follows:

First, that for street railway use a hard rail will give the best results.

Second, that the most economical way to secure this hardness is by increase of carbon, accepting the manufacturer's standard specifications for the other ingredients.

Third, that the next step should be towards an improvement of the joints.

As is well known to all present, the writer has pinned his faith to the electric welded joint as settling the question once for all by making the union homogeneous with the rail and possessing an advantage from an electrical standpoint in the matter of conductivity. Nevertheless the cast-welded method also demands careful consideration. It is certainly preferable to anything in the nature of splice bars that we know of, provided one glaring fault can be overcome, viz.: the softening of the steel that occurs from the large body of hot cast metal located at that point, and it would appear that some means could be devised to overcome this evil.

Fourth, after making the joints perfect, what we have termed the "West End rail" would certainly justify its extra cost. As the analysis of each rail is embodied in this paper I need not here refer to it.

The great lesson I would once more emphasize is that until you get the joints perfect you need not worry about the quality of your steel; anything in the shape of steel—the very cheapest you can buy—will last longer than the joints will permit you to keep your rails in the track.

The Cost of City Traction.

President Vreeland, of the Metropolitan Street Railway Company, New York City, has furnished to the "Street Railway Journal" comprehensive tables showing the cost, earning capacity, etc., of the various street lines under his control; on this the "Journal" has compiled an exhaustive review of the subject as relates to the conduit trolley and other powers.

While the experience of several years must be awaited before exact conclusions can be reached on such questions as the cost of maintenance and renewals, actual operating cost figures are now at hand on which to base some satisfactory estimates. An idea of the relative cost may be gained from the following table extracted from President Vreeland's statement, covering the quarter ending September 30:

	Cable.	Electric.	Horse.
Mileage	27.4%	39.1%	33.7%
Receipts per car mile	$0.333	$0.260	$0.288
Operating expenses per car mile	0.175	0.100	0.179
Net earnings per car mile	0.157	0.159	0.109
Prop. operating expenses to gross	52.7%	38.6%	62.1%
Detailed expenses per car mile:			
Power	$0.020	$0.013	$0.069
Transportation	0.079	0.064	0.082
General	0.014	0.009	0.016

These and other figures are discussed editorially in the present issue of The Engineer.

Electric Traction by Water Power on Italian Railways.

THE high cost of coal in Italy has induced the Italian Government to consider the possibilities of electric traction on the railways, which in Italy are owned by the Government, but operated by private companes, utilizing the abundant water power of the Peninsula. Attention has been recently attracted to this problem by a publication on the subject by A. Afan De Rivera, ex-Minister of Public Works of Italy. The aim of the writer, in pointing out the possibilities of utilizing the considerable water powers of Italy for the electrical operation of most of the Italian railways, is to demonstrate the necessity of the Government protecting its own interests, by exercising great caution in awarding concessions for the use of water powers, refusing them whenever it should be thought to be of future advantage to the State, especially in case the applicants for concessions are mere speculators or acting for third parties. He recommends to the Government to invite reliable concerns to submit plans and make trial tests on a large scale, limiting, however, the obligation of the Government to the payment of a stipulated amount in case the trial tests are satisfactory and in accordance with contract specifications. The Government should not be under any obligations to the contractor should the tests prove unsatisfactory, the latter in this case assuming all charges for changing over and returning to original conditions the entire equipment upon which the test was made.

Technically, the writer of the pamphlet advocates the third-rail system, basing his argument upon the results obtained with the third rail by the New York, New Haven & Hartford Ry.; he also advocates the series system, which constitutes a block system, and, in his opinion, reduces to a minimum the causes of accidents. In the opinion of the author, who is a general in the army, requirements for the safe defence of the country from either external or internal enemies, would absolutely prohibit the ærial trolley on the Italian railways, and the third-rail system seems to him the only one admissible at the present time. He, however, in this proscription, does not include the overhead feeder transmission line from the generating station to the railway.

Replying to the publication of A. Afan De Rivera, the railway company operating the "Adriatica" line points out the inconsistency of prohibiting the ærial trolley on the portion along the railroad for reasons of national defence, but allowing it to be used on the main transmission line, which is the main artery connecting the railway with the very heart of the system, namely, the central station. Electric traction, says the Adriatica Company, must be taken as it is, with all its advantages and all its faults, and if it is true that important economies, increased safety and improved service can be expected from the centralization of the generators of energy, we must expect some disadvantage

Digitized by Google

of this system such as the risk of interrupting the whole railway service increased, as it would be in the case of electric traction, by the greater liability of a breakdown either in the central station or on the primary feeder lines. In this particular the ærial trolley and the third-rail systems are equally vulnerable.

The publication seems to be of a political character, and there appears to be a desire to discredit the work of political opponents who have lately dealt with this matter in Italy.

A Real Trolley Road for London.

A special dispatch from London, England, of Oct. 11, says: "The American trolley car yesterday won the first victory in London. The Highways Committee recommended the granting of permission to the United Tramways Company to equip with the overhead trolley a part of its track on the Uxbridge Road, a thickly settled part of the West End, though not in the fashionable section. As a concession to the prejudice of conservative Londoners the company promised to discontinue it if the line proves unsuitable. For years capitalists have tried to introduce the trolley system in London, but until now their efforts have been vain. The old tram cars were never allowed to run within the limits of the 'city,' and those in the metropolitan district are ramshackle, double-decked horse affairs. Surface traffic of passengers is now transacted almost wholly by omnibus and cab."

A Trolley for Santiago de Cuba.

A franchise for an electric road from Santiago to the cemetery and to El Caney has been granted by Gen. Wood to prominent local business representatives. It will be an immense boon to the public, though hardly likely to pay more than expenses for the first three years.

A LABORATORY MANUAL OF ELECTRO-THERAPEUTICS. By Prof. Wm. J. Herdman and Frank W. Nagler, B.S. Ann Arbor: George Wahr, 1898. 163 pages; 5¾x9 inches; 53 illustrations. Cloth. Price, $1.50.

There was a time when the majority of the popular electrical works were written by men carrying the title of M. D. after their names. Those volumes are long since out of date and no regrets need be felt at their passing. The physician of to-day, however, is in some respects relatively less well-equipped than his brother of fifty years ago, for the simple reason that the science of electricity, especially that branch devoted to electro-therapeutics, has all been developed, one may say, within the last twenty or twenty-five years. Not that electricity was not used before that period—we need only recall the Abbé Nollet—but it is only within a comparatively recent period that it has been studied systematically as a healing agent, and the laws laid down for its intelligent application.

The authors have in this work given us the results of their experience as teachers in the laboratory, and in fact the work is designed as a laboratory manual for the student of medicine, concerning electricity and its relation to animal economy. As a laboratory manual, therefore, the work is of an intensely practical nature, and every statement is followed up by experiment and example, so that he who follows it out will have the subject thoroughly inculcated in his mind.

The first part of the work is devoted to experiments meant to familiarize the student with the electrical apparatus he has to deal with and the principles of electrical measurements which these instruments are designed to record. This is followed by descriptions of and experiments with the apparatus used by the physician in his electrical practice, including the galvano-cautery, apparatus for cataphoresis, electrolysis, induction machines of various kinds, etc. The practical application of all these various apparatuses is fully gone into. At the end of the work we find adequate reference to diagnosis by the X-rays and the methods of their application. We also notice a very interesting short chapter on the relation of magnetism to living organism. The experiments made by the authors are similar to those reported by d'Arsonval, to the effect that the alternating magnetic stress is in some way related to a quickened metabolism of tissue; that magnetic energy goes through some transformation and appears as physiological energy. It is to be noted, however, that while the currents employed by d'Arsonval were of the high potential and high frequency character, the current employed by the authors was only of 52 volts pressure, and the frequency of alternation but 248 per second.

The work ought to find ready acceptance among physicians and others interested in electro-therapeutic work.

Conditions of Luminosity in Vacuum Tubes.

Mr. Edwin S. Ferry has a communication to the "Physical Review" on the relations between pressure, current, and luminosity of the spectra of pure gases in vacuum tubes. He describes his methods, fully, and gives his results in a series of tables and curves, which lead to the following conclusions regarding the luminosity of the separate spectral lines of gases in vacuum tubes under different conditions of pressure and current strength: (1) With gas pressure of from 0.25 mm. to 4.00 mm. of mercury, and current strengths of from one milliampere to six milliamperes, the luminosity of the separate spectral lines of gases at a given pressure is directly proportional to the amount of strength. This is in exact parallelism with K. Angstrom's observation that the energy of the luminous radiation, as well as the total radiant energy of a gas rendered luminous by an electric current, is directly proportional to the current strength. (2) With constant current, the luminosity of a spectral line of a gas increases as the pressure decreases, at first slowly and then more rapidly. The curve showing the relation between the pressure of the gas and the luminosity of a spectral line is regular, but is different for different lines. The research work was performed in the Physical Institute of the University at Upsala, and in conclusion the author expresses his obligations and thanks to Prof. Knut Angstrom for the assistance and encouragement he received from him.

The Magnetic Deflection of Diffusely Reflected Cathode Rays.[1]

BY ERNEST MERRITT.

IT is now known that X-rays are developed in a Crookes' tube at all places where the cathode rays encounter a solid obstacle. In the tubes now made the cathode rays are usually "focussed" on a piece of sheet platinum, and the X-rays proceed from this focus. But other rays are developed at this point as well as Röntgen rays, and are the cause of the brilliant fluorescence which usually covers about half the glass of such tubes. These rays are deflected by a magnet like cathode rays. In this they differ from X-rays, which are entirely unaffected by the most powerful magnetic field. Goldstein, who first observed these rays, believed them to be cathode rays that had been diffusely reflected from the platinum, just as light would be scattered by a roughened surface. S. P. Thompson believed that the rays were intermediate between cathode rays and X-rays, and has proposed for them the name "para-cathodic rays."

The author has measured the deflection of the "para-cathodic rays" in a given magnetic field, and compared it with the magnetic deflection of the direct cathode rays in the same tube. No difference could be detected in the behavior of the two sets of rays. This fact must be looked upon as an argument in favor of Goldstein's view. According to the generally accepted theory, cathode rays consist of small negatively charged particles repelled at enormous speed from the cathode. It seems probable that when these particles strike an obstacle some are stopped, and by their impact produce the X-rays; a few of the particles may, however, rebound like elastic balls. The particles that rebound will then travel off with practically undiminished velocity and will form the "para-cathodic rays," possessing all the properties of the original cathode rays. The author is therefore of the opinion that "para-cathodic rays" are really the same as cathode rays, and result from diffuse reflection.

[1]Read before the A. A. A. S. Abstract.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Beta Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1888.]

Vol. XXVI NEW YORK, NOVEMBER 10, 1898. No. 549.

Farewell to the Street Railway Cable.

IN sharp contrast to the policy pursued by certain street railway managers in keeping from those engaged in similar pursuits the results of their experience, is the recent generous action of Mr. H. H. Vreeland, president of the Metropolitan Street Railway Company, of New York City, in giving to the street railway public a transcript of the private cost sheets and other records of that great company. These interesting figures, published in the November issue of the "Street Railway Journal," are really the first in the history of street railroading, by means of which a true comparison of the relative cost of operation of cable, electric and horse railways in a single city and under substantially the same conditions can be made. It is, of course, needless to remark that on account of the honesty of the figures, the accuracy of their distribution among the different branches of the service, and the careful methods of administration and of bookkeeping pursued by a company transporting over 250,000,000 passengers per annum, their importance to railway companies cannot be overestimated. Particularly to foreign railway managers, who are contemplating a change of motive power these figures will come as a Godsend and will materially aid them in their work and shed light on many obscure and difficult problems which they will be called upon to solve. However, in attempting to apply the results of this company's experience to any particular road, it should be borne in mind that they are the outcome of an experience in a city which is peculiarly favored in the matter of climate and cleanliness or dryness of streets, the rainfall and snowfall during the year being extremely small. And again, how many cities have a traffic of sufficient density to warrant them to construct a system of railways costing initially $50,000 to $100,000 per mile of single track? The introduction of or change to such a system, having reference to the underground conduit, would mean the financial ruin of most small street railway companies.

Leaving then the correct use of these significant figures to the judgment of each individual company, they provide abundant material from which general conclusions regarding the relative advantages of cable, electric and horse railway operation can be drawn. They prove once again most conclusively that the power of the horse must be exerted in other directions in the future than in the propulsion of street cars, and that from economical considerations alone there is no place for the cable in modern street railroading. To show what faith the Metropolitan Company has in its improved electric trolley conduit system we need only mention the astounding fact that during the last fifteen months, 35 miles of double track have been converted from horse to underground electric traction on Second, Madison, Sixth, Eighth and Amsterdam avenues—all great through North and South routes—and on Fifty-ninth street. During the past few weeks work has also been begun on the Broadway line, and even later than that, the Third avenue Railroad Company, a competing system, has broken ground for the introduction of the electric conduit system on Third avenue, the Boulevard and 125th street. And the end is not yet in sight, for this is surely only a beginning of what will eventually be the introduction of the new motive power on every mile of street railway in New York City. There is not much left now to be "changed over."

Naturally, then, in considering the figures from which the following conclusions are drawn it must be borne in mind that they are the results of operation during a period of reconstruction which is obviously very unfavorable on account of the great interruption of traffic and even a temporary diminution of receipts. Taking up then the annual and quarterly reports, we find that during the twelve months period the company operated 34.2 per cent. of its car mileage by the cable system, 20.2 per cent. by the electric system and 45.6 per cent. by horses. During the last quarter, however, the conditions were greatly changed, the cable mileage being only 27.4 per cent. of the total, the horse 33.7 per cent., while the electric had risen to 39.1 per cent. An interesting gauge of traffic density is found in the statement that the 11 per cent. of the company's entire mileage which is operated by the cable system is earning 28 per cent. of the total passenger receipts; the 28 per cent. which is operated by the electric system is earning 32 per cent. of the total passenger receipts, and the 61 per cent. which is operated by horses is earning only 30 per cent. of that item.

For the year the operating expenses of the cable lines were 16.42 cents per car mile, of the horse lines 17.87 cents and of the electric lines 10.23 cents. For the three months period, which is more favorable to electric operation, the cable lines cost 17.55 cents, the horse 17.89 cents and the electric 10.06 cents.

The electric lines during the twelve months period earned 16.76 cents net per car mile, or but 1.25 cents less than the cable system, in spite of the fact that the latter has 7.43 cents per car mile greater receipts, while for the three months period the net earnings of the electric lines per car mile were actually greater than the cable lines by .25 cents, and greater than those of the horse lines by 5.04 cents.

Considering these and other figures, too numerous to mention here, the "Street Railway Journal" believes that were all lines in New York City to be equipped with a single motive power, electricity would have a permanent advantage over the cable of at least 3.5 cents per car mile in maintenance of way; a slight disadvantage in maintenance of equipment, and an advantage of at least 1.25 cents in power, of 1.5 cents in transportation, and of .5 cent in general expenses, a total of nearly 6.75 cents per car mile. In comparison with horse traction, electricity would be at a disadvantage of perhaps .5 cent per car mile in maintenance of way and .5 cent in maintenance of equipment; while it would have an advantage of at least .6 cent in motive power, 1.5 cents in transportation, and 5 cents in general expenses; a net difference of 7 cents. Besides this electric cars would earn more than either horse or cable cars with equivalent mileage.

Other figures are given showing the relative costs of track repairs, transportation and general expense, and the conclusions are reached that during the twelve months' period, the cable lines operated at 47.7 per cent. of their passenger receipts, the electric lines at 37.9 per cent., the horse lines at 65.3 per cent., and the entire system at 53.3 per cent. During the three months' period the cable lines operated at 52.7 per cent. of their passenger receipts, the electric lines at 38.6 per cent., the horse lines at 62.1 per cent., and the entire system at 50.9 per cent.

In view of the much criticized policy of the company in acquiring for enormous rentals operating control over existing roads, it may be of sufficient interest to show the influence upon gross and net earnings in toto and per mile of road operated of these successive acquisitions. It is seen from the tables that the gross receipts have increased from $4,022,723 in 1893, to $10,779,087 in 1898, excluding Second avenue; the earnings from operation have increased from $1,326,396 to $5,289,982, and while the fixed charges have shown a large increase, the earnings over charges applicable to dividends on the company's stock have increased from $117,794 to $1,787,651, a figure in 1898 more than fifteen times as great as in 1893. The gross receipts per mile of road have nearly doubled and the net earnings per mile over charges have increased nearly tenfold. These figures are certainly a splendid testimony to the soundness of the policy and fitness of the motive power adopted by the company.

Digitized by Google

The Popularity of the Enclosed Arc.

FEW developments in electric lighting of late years have been more remarkable than the perfection and rapid popularity of the enclosed arc. Only a year or two ago only open arcs were manufactured, and the revived attempts to produce a practical lamp of the other type were viewed in many quarters with no small amount of scepticism. At the present time it might be said that it is pretty hard to count up half-a-dozen manufacturers of open arcs, while we possibly understate it if we say there are two score makers of the enclosed form. This is certainly a great and swift change, and the result has been the widespread use of the enclosed lamp. Nevertheless, it cannot be said that the revolution had been complete until recently, owing to the fact that the use of the new form was chiefly restricted to interior service, for which it had many special recommendations, such as were pointed out in our pages lately in an article on store lighting in New England.

We are glad to note therefore the action in Boston, where the enclosed arc has been definitely accepted for public street use, as part of the admirable city contract made on a 10-year basis with the Boston Electric Light Co. The Mayor of the city, in speaking of the change, says: "The perfecting of this lamp makes a decided advance in the art of electric lighting, and Boston will thus be the first city to be equipped with it, thus affording our citizens a service which will be superior to any in the world." The fact that so shrewd and competent a man as President Gilbert should assume the responsibility of such a contract, speaks volumes for the new method of illumination. Under his progressive and able management Boston has been a Brush stronghold these many years, employing the beautiful and brilliant open arc light with which the industry took its first great leap forward, and that he should now make this change is an event of the utmost significance to the art. We agree with the Mayor of Boston that the city is to be heartily congratulated.

Telegraph Lines in Cuba.

GEN. GREELY, Chief of the Signal Corps, has been reporting of late quite exhaustively on the telegraphs in Cuba and Porto Rico, and touches incidentally on a point of importance at the present juncture of affairs, namely, the ownership of the telegraph lines in the two islands. In both islands, the lines belonged to the Spanish Government. When the Cubans get a government of their own, the lines can be turned over to it, but meantime our army authorities will have to operate them. But the Island of Porto Rico now belongs, virtually, to this country; at least no other ownership is in contemplation. This being so it may be timely to point out that the Government ownership of telegraphs is repugnant to the spirit of our institutions. The lines should at once be sold to a private corporation, and left to distinctive private operation. We believe there is a good opening, not only for an efficient telegraph system but a large telephone service. The physical conditions are against travel in both islands, and there is no reason why the telephone should not enjoy as large a patronage in Cuba or Porto Rico as it now does in the Sandwich Islands.

The Trolley and the Dublin Jarvey.

THE trolley is cutting deeply into many old-fashioned ways and trades, but it has borne with peculiar heaviness on the man who drives the horse. The busses have disappeared from our cities. At Niagara, the hackman is far less pervasive and expensive than he was before the cataract came in competition with his team. Not long ago we gave publicity to a poetical wail from Ceylon that the rickshaw and its unshod coolie in khaki suit and belt of red were disappearing before the "Western tramway car." And now comes the complaint that the famous Dublin "jarvey" is on the eve of extinction, because from being the "car drivingest" city in Europe Dublin has been turned into the "electric trammiest." This is a great pity, and we commend this latest abolition of the picturesque to the notice of the Niagara Commissioners, who think theirs is the only grievance of this nature worth attention. Dublin with its wide streets is peculiarly fitted for trolley construction, and the electric car therefore flourishes within the gates to which people have hitherto flocked for the finest annual horse fair in the world. "We mourn our loss," but what can be done about it? We loved that witty jarvey, and fear for the future of Irish humor, but is electricity to blame?

LEGAL NOTES

Injury from Street Car Collision.

Terence F. Wynne on the afternoon of Oct. 6, 1893, was a passenger on a horse car of the Brooklyn Heights Railroad Company, proceeding along Atlantic avenue. The car stopped to permit some passengers to alight, and before it started up again a trolley car of the Atlantic Avenue Railroad Company coming on the same track from behind crashed into the rear of the horse car sufficient to make a hole in the rear dashboard. The shock threw Mr. Wynne from his seat against the seat on the opposite side of the car, causing severe injuries. In his suit against the trolley company, in the City Court of Brooklyn, Mr. Wynne was given a verdict for $3,200. An affirmance by the General Term of that court has now been upheld by the Court of Appeals. Justice Bradley, in his opinion in the court below, which was concurred in by Justice Van Wyck, held that it was the duty of the motorman, on seeing a horse car in front of it, to maintain such a distance therefrom, or to so reduce the speed of his own car, that he could stop it in time to prevent a collision. The motorman admitted he saw the horse car slowing up when it was about fifty feet ahead of him, but that he did not put on his brake until his car was within twenty or twenty-five feet of the horse car, and that then he was unable to stop his car in time to avoid a collision, in consequence of the rails being slippery.

An Unusual Telegraph Litigation.

At Lansing, Mich., on Oct. 18, the judgment attained by John Carland, a Corunna merchant, against the Western Union Telegraph Company, for failure to promptly transmit and deliver a telegraph message, on account of which Carland suffered a loss, was affirmed by the State Supreme Court. Carland called the telegraph office by telephone and directed the operator to send a message to Chicago for the purchase of 3,000 bushels of wheat. The message was not received in Chicago. The price of wheat went up, and Carland claimed damages. The telegraph company claimed that the operator had no authority to receive the message by telephone, and that in doing so he was acting as agent for Carland, who should have written the message. This contention the court overruled, holding that the use of a convenience like the telephone should not be entirely at the risk of the patron. It was contended that the telegram was sent in furtherance of a gambling contract, but as it was not proven that the telegram was sent for the purchase of wheat on margins, the court holds that he had a right to recover.

Lower Duty Collected on Incandescent Lamps.

The Board of Classification of the United States General Appraisers has announced a decision regarding the tariff on incandescent electric lamps, on which the Collector at this port had assessed a duty of 60 per cent. ad valorem as glass. The Board holds that, while glass is the component material of chief value, yet the other materials—carbon filament, porcelain, metal and cement—are so essential to the character of the lamp that it ceases to be merely blown glassware. The protest of the importers is sustained, and the duty fixed at 45 per cent.

Damages for Cutting the Manila Cable.

At a meeting on Oct. 26 in London of the Eastern Extension Telegraph Company, the Marquis of Tweeddale, the chairman, said that the company's claim against the United States for cutting the Manila cable has not yet been admitted. The occupation of the Philippine Islands by the American forces, he added, had given a great impetus to the project of building a Pacific cable; but, he added, nothing definite has yet been arranged.

I would not know what to do without the Engineer.—E. S.

Digitized by Google

MISCELLANEOUS

Experiments with High Frequency Currents.

IN a recent number of La Nature are described several interesting experiments with high frequency currents and apparatus for carrying them out, designed by M. P. Dosne. As shown in the accompanying illustration, Fig. 1, a Ruhmkorff coil is employed giving a four-inch spark, the coil being in connection with the two inner coatings of two Leyden jars, C. These jars consist of two glass vessels covered interiorly and exteriorly with a tin foil coat to three-quarters of their height. In the centre there is a copper rod bent at right angles connected by a chain to the interior of the vessel. The sparks pass between the points A to the terminals a. The external coatings of the jars connect with a plate of zinc provided with binding posts. A heavy copper wire connects these binding posts with the ends of a solenoid surrounding a glass bottle with a wide mouth six inches in diameter. In the centre of this bottle is a paper cylinder three centimeters in diameter, on which is wound an insulated wire .2 of a millimetre in diameter. One end of this wire is connected to a little rod and the other to a small canopy of zinc, the roof of which is of parabolic shape. When the oscillator a operates, high tension currents are obtained at the terminals of the transformer D, from which an intense field is formed in the canopy E. In this condition the Geissler tubes are illuminated in the field and a series of experiments can be carried out.

Another type of transformer can be obtained by adopting the arrangement shown in Fig. 2. In this illustration No. 1 shows the interior of an ebonite tube five centimeters in diameter on which is wound an insulated wire and around this a wooden cylinder having wound on it a solenoid of bare copper wire. The whole is placed in a test tube without a bottom and provided with a special stopper; the tube is finally filled with mineral oil. A certain quantity of ozonized air can be easily obtained by stretching in the interior of a glass tube, Fig. 2, a platinum wire, and connecting the ends of that wire to a source of high frequency currents. The outside of the tube is covered with tin foil. Air is then forced into the tube through the tip a, which passes out at Z.

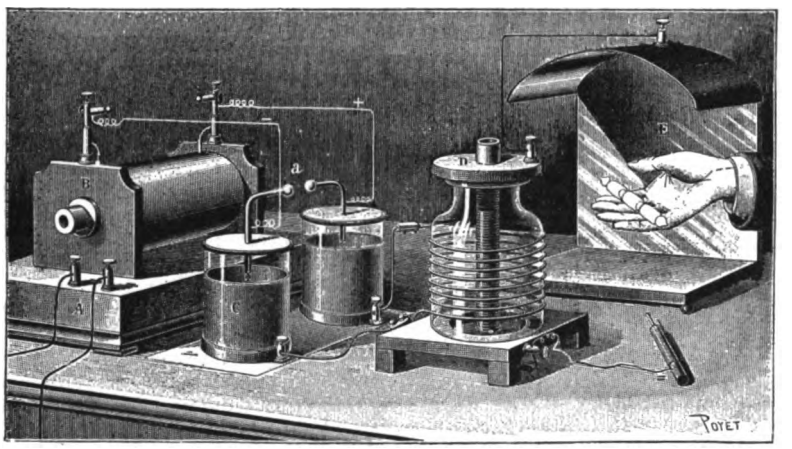


FIG. 1.—EXPERIMENTS WITH HIGH FREQUENCY CURRENTS.

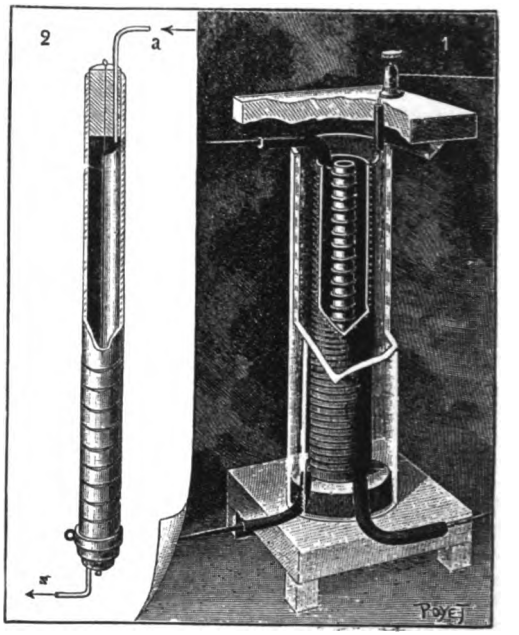


FIG. 2.—MODEL OF TRANSFORMER AND OZONATOR.

The Electrical Resistance of Iron Wires.[1]

BY ERNEST MERRITT.

THE electrical resistance of iron wires is known to be much greater for alternating currents than for direct currents. If the magnetic permeability of the wire were constant it would be easy to compute how great the resistance would be in any given case. But in the case of iron such computations are very uncertain. At the suggestion of the writer measurements of resistance were made by Mr. H. H. Denio for a number of different iron wires, with an alternating current of 135 periods per second. It was found that for small currents the resistance was the same as for direct currents. As the current increased the resistance offered to alternating currents became greater, and finally reached a maximum. The greatest resistance was usually about three times as great as that offered by the same wire to direct currents. For very heavy currents the resistance decreased again, owing probably to the partial saturation of the outer layers of iron.

[1]Read before the A. A. S. S. Abstract.

Electricity at the British Association Meeting.

THE report of the Electrical Standards Committee is a record of progress made in the determination of the standard ampere. Profs. Ayrton and J. V. Jones have designed an ampere balance, for the construction of which a grant has been made by the association. The details of the instrument were described to the section. An appendix to the report contains an account of the determination of the temperature coefficients of two coils used in the determination of the ohm by Profs. Ayrton and Jones, the measurements having been made by Mr. M. Solomon. The coils do not appear to have changed since 1896, but their resistances as measured in 1894 were slightly lower (0.006 to 0.007 per cent.) than the present values.

The Electrolysis Committee has investigated the electrical conductivity and the freezing point of several dilute solutions of salts, which furnish some unexpected and, therefore, interesting results. The data are, however, not yet complete. The report was accompanied by a paper from Mr. Whetham on the measurement of the electric conductivity, and one from Mr. E. H. Griffiths on the freezing point determinations.

Mr. S. Skinner has investigated the carbon-consuming cell of Jacques, consisting of an iron crucible into which is put fused caustic soda with a carbon rod as electrode, the crucible forming the other electrode. In order to maintain the electromotive force of the cell, air is blown into the caustic soda. Mr. Skinner found that the air acts by cleaning the surface of the iron crucible, and can be usefully replaced by adding sodium peroxide to the caustic soda. By measuring the current furnished by the cell, and the loss of weight of the carbon electrode per second, the author hopes to determine the electro-chemical equivalent of carbon.

Messrs. Cahen and Donaldson communicated the results of some comparisons of the output and efficiency of a secondary cell (Tudor type) when charged at constant current and constant electromotive force respectively. By charging at constant potential the time of charging is reduced to less than half that required at constant current, the capacity is thirty per cent. greater, but the energy efficiency is ten per cent. less. Neither method of charging appears to damage the cell.

Digitized by Google

Mrs. Ayrton read a paper on the drop of potential at the terminals of the electric arc, in which she described the exploration of potential distribution in the arc by means of a third electrode of carbon inserted laterally. If the arc be maintained at constant length the power expended at each carbon is a linear function of the current, and if the current be maintained constant the power expended at each carbon is a linear function of the arc-length. The experiments are subject to errors pointed out by Mrs. Ayrton in her paper: (1) the third carbon may not take up the potential of the point of the arc in which it is placed; (2) it alters the potential-distribution and the length of the arc. The author proposes to repeat her experiments, using an insulted third carbon.

Prof. Chattock described experiments to determine the velocity of electricity in the electric wind. He finds that the electricity in the electric wind travels much more rapidly than the gaseous particles themselves, reaching in hydrogen a velocity of 900 cm. per second.

Profs. Rosa and A. W. Smith have investigated the heating effect of alternating currents upon the dielectric of a condenser, measuring the net watts supplied to the condenser and the heat developed per second in the dielectric. Their results were communicated to the section by Prof. Rosa. Mr. F. B. Fawcett described standard high resistances constructed by depositing cathode films on glass and heating them for a long time in a partial vacuum; this process renders them constant. Prof. Callendar exhibited a platinum voltmeter, in which the change of temperature of a platinum wire on passing a current through it is utilized to measure the current, and hence electromotive force; the instrument is made self-recording. Mr. E. H. Griffiths exhibited an apparatus for the measurement of resistance, by which the resistance of a coil can be measured to within one part in three millions.

Prof. Lodge described a new magnifying telephone, for calling up the operator at the receiving end in systems of wireless telegraphy. The minute current set up in the receiving circuit passes through a small, light coil suspended in a strong magnetic field and rigidly attached to the disc of a microphone transmitter; the coil moves, and so sets the microphone disc in motion. A relay current in the microphone circuit is thus interrupted, and can be sent through the coil of a second similar apparatus. By using three or four magnifications a slight sound can be made to approximate in intensity to the human voice.

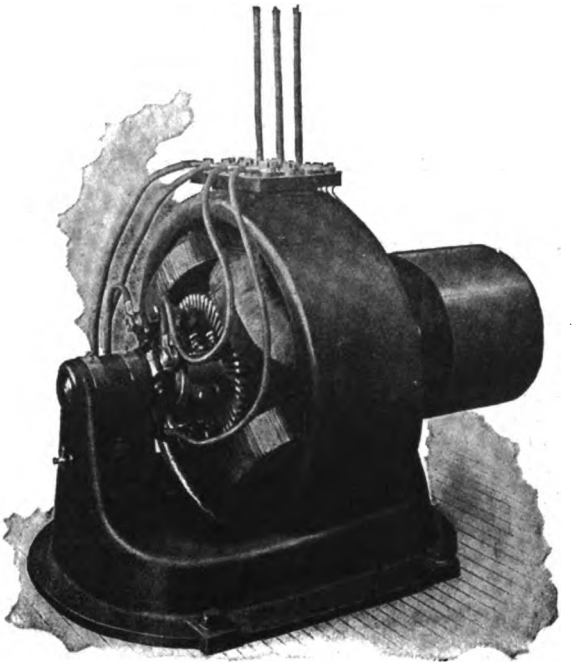
Prof. Barrett, Messrs. W. Brown and R. A. Hadfield communicated the results of some determinations of the electrical conductivity and magnetic permeability of various nickel-steels. Prof. S. Lemström and Dr. E. H. Cook read papers on the action of electricity on plants. Both agree that the growth of plants, is accelerated by electrical discharges or currents; Dr. Cook, however, considers that the increased growth takes place only during germination of the seed and its growth underground, the mature plant being unaffected by electrical actions. In another paper, Dr. Cook described experiments on the reflexion of the brush discharge.

The discussion on the magnetic and electrolytic actions of electric railways was opened by Dr. Schott, who described the total destruction of two American magnetic observatories by the approach of electric street railways. Prof. Rücker indicated disturbances of a magnetometer needle due to the South London Electric Railway felt as far away as 3½ miles, and referred to the complete destruction of the Greenwich vertical force and earth-current records. He pointed out that the trouble could be remedied if electrical engineers would meet physicists in a friendly way, as they had done hitherto in this country. The principal disturbances arise from want of insulation of the return circuits of railway systems and the excessive distance between the outward and return circuits; the former gives rise to earth currents, and the latter to magnetic induction. Dr. Eschenhagen stated that in conjunction with Prof. von Bezold he had found a disturbance of magnetic instruments at a distance of 15 kilometres from electrical railways near Potsdam. Mr. W. H. Preece claimed protection for telegraphs and telephones as well as for magnetic observatories; the telephone, however, when provided with a complete twisted metallic circuit, is not capable of being disturbed, but earth-currents due to leakage seriously interfere with telegraphic work. Signor Palazzo described a method of damping the swings of a magnetometer needle so as to make it unsensitive to small-period oscillations. Prof. Fleming gave many instances of corrosion of gas and water pipes by electrolytic action, the pipes forming part of the earth-return of a leaky circuit. Prof. S. P. Thompson suggested the use of alternating currents and no earth-return, or of continuous currents with well-insulated circuits and the return wire very close to the outward circuit. Prof. Ayrton pointed out that it was to the advantage of the electrical engineer himself to use a well-insulated return-circuit.

ELECTRIC LIGHTING.

The Rushmore 3-Wire Dynamo.

UP to a few years ago the three-wire system was employed for all large isolated plants and small, low tension stations, by reason of the large saving in copper over the two-wire system. It was found, however, that where the all-day load is less than the capacity of two of the standard units employed, the losses in operating the small or lightly loaded machines offset the saving in copper at full load, and therefore in most plants recently installed the simple two-wire system is used and many small stations are now using the two-wire system with 250 volt



RUSHMORE 3-WIRE 220 VOLT DYNAMO.

lamps, although the higher price of such lamps and the lower efficiency offsets the saving in copper.

Several methods have been devised for supplying a three-wire system from a single machine with small motor generators to balance the system, and a few machines have been built with double armature winding and two commutators; but all these methods have been more or less complicated and none will operate when the system is badly out of balance.

There has lately been placed on the market a machine that will supply a three-wire system and maintain the voltage with any distribution of load. The machine is of the usual multipolar construction, with single armature winding, single commutator, etc. It differs from the ordinary machines only in the manner of exciting the fields, which is a modification of the well-known multi-circuit system perfected by Mr. Rushmore in his multi-voltage dynamos, described and illustrated in our issue of Feb. 3, 1898, and in his motor dynamos and multi-circuit arc machine.

There is now in operation at the Rushmore Works, Hudson and Morris streets, Jersey City, N. J., a 30 k. w. machine, shown, supplying a three-wire system, that fulfils all of the conditions of two 110 volt machines in series.

It will deliver its entire output at 220 volts or at 110 volts, and one side may be loaded to 75 per cent. of the total k. w. capacity

Digitized by Google

of the machine without loss in efficiency, and without interference with the other side, which may or may not be loaded. The brushes are fixed and there is no sparking under any distribution of load. One side of the system may be kept constant at any voltage and the other raised or lowered to any extent without the least interference.

It is believed that this type of machine will come into extensive use in large and small plants, as with it the three-wire system may be employed with all its saving in copper and without the losses of running two small or lightly loaded machines at periods of light load.

Fire Risk with the Vitascope, Etc.

MR. W. BROPHY, in a paper before the International Association of Fire Engineers, at St. Louis, discussed the serious fire dangers of apparatus for showing animated pictures. The terrible calamity in Paris need hardly be recalled to justify Mr. Brophy's warnings. Speaking of precautions where electricity is used, he said: Is the exhibition of animated photography attended by dangers that cannot be entirely removed or prevented? I say, most emphatically, no, it is not. A few simple rules rigidly adhered to and the necessary amount of care and intelligence on the part of the operator will prevent all accidental fires from this cause. The operator should thoroughly understand all the mechanism, know just where the possible danger is, and be ever ready to remove or prevent it quickly. No boy without any sense of responsibility, no drunkard, or one addicted to over-indulgence in strong drink, and no careless lout, with no aim or purpose other than to do as little as possible during his waking hours, should be placed in charge of this apparatus. While the very highest order of intelligence may not be necessary in the operators, they should belong to a class above the ordinary; this is absolutely necessary where so much depends on their individual care and effort. If an arc lamp is used, it should be inclosed in a metal or metal-lined box (as a matter of fact this is done in all first-class machines). If it is in an open room, a large metal pan containing sand should be placed under it. The frame for the lens should be of metal. A shutter should be provided between lens and film, cutting off light from the frame when its movement is interrupted by accident or otherwise; it should close automatically and be held open by the foot of the operator when the film is in motion, or a glass vessel filled with a solution of alum water should be placed between the lens and the film. This last precaution should be taken in all cases where films less than the standard width are used. Films should be wound and unwound on metal reels, which should be kept in metal cases. Films not in use should be kept in metal boxes provided with self-closing covers kept securely closed, except when it is necessary to remove or replace these films. The lamps, reels, films, belts, and pulleys should be contained in a cabinet of metal, or wood metal lined, the working side to have a door that could instantly shut in case of accident. The motor, controlling rheostat, switch and fuse-block, should be outside the cabinet. The resistance coils should be largely in excess of the current capacity of the motor, so as to prevent excessive heating, and the electric wiring and fixtures should be done in accordance with the "National Code." The electric light is preferable to calcium, acetylene, or gas light, for the former requires neither match nor flame to light it.

TWENTIETH TRIENNIAL EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, BOSTON, OCTOBER 10 TO DECEMBER 3, 1898.—III.

New England Telephone and Telegraph Company's Exhibit.

THE exhibit of the N. E. T. & T. Co. is novel in many of its features and proves a great attraction to the throng of sightseers who daily visit the fair.

The principal exhibition platform occupied by this company is located in Grand Hall, near the stage. It is about 25 feet square, richly carpeted, and on each of the four corners is located an elegantly finished public station booth, with its carved woodwork, ornamental windows and silk curtains, and brilliantly lighted in the interior by electric lights. These booths, shown in the illustration, form an artistic and appropriate setting for the other attractions of the exhibit. In front of this space there rises from the centre a telephone pole equipped with cross-arms carrying large copper wires which extend from the arms in both directions to the opposite ends of the hall. Beneath these wires are suspended in skeleton letters the words Bar Harbor, Montreal, Portland, Springfield, New York, Chicago, etc., suggestive of the fact that this exhibit is in direct communication with the telephonic world. The pole, nicely silvered, having a circular upholstered seat which surrounds its base, and four cables festooned from beneath the arms to the tops of the booths is altogether an ornamental as well as a suggestive feature. Extending overhead from booth to booth, on three sides, is a wire strung with telephone receivers making a fringe above and around the exhibit, while on the top of the booths are placed large potted ferns which give a graceful appearance, in keeping with the Japanese Garden, which is the stage attraction of the fair.

Upon the platform are placed three Central Office switchboards, one of which is equipped with modern lamp signals and is constantly attended by a lady operator.

In the centre of the space is a large circular table, on which are arranged twenty telephones connecting with the Worcester Exchange, nearly fifty miles distant. By placing these telephones to their ears, the visitors may, at any time, listen to both instrumental and vocal music alternating with reading and conversation. Perhaps the most striking feature in this part of the exhibit is the reproduction of music from a cornet played in Worcester. This is accomplished by means of powerful receivers suspended above the table.

It is amusing to notice the incredulity of some of the visitors when listening to this music, which is loud enough to be heard in any part of the large hall. More than one person has been observed to raise the table cover for the purpose of discovering the origin of the music, while another was heard to say that it must come from the gallery, as the wires on the pole extended to that point.

There is exhibited an exact model of the first speaking tele-

N. E. TELEPHONE & TELEGRAPH CO.'S EXHIBIT, MECHANICS' FAIR.

phone, as it was invented by Alexander Graham Bell, in 1875, also specimens of the many forms of instruments used to-day. Visitors are also shown the operation of the switchboard and such of them as have never spoken over a long line are given the

Digitized by Google

privilege of speaking to the most Eastern points reached by telephone.

In the basement of this hall there are arranged upon a suitable rack thirty-two telephones, which are in connection with suitable transmitters, located at Keith's Theatre, on Washington street, Boston. By this means patrons of the fair can listen to the continuous performance upon the stage, including the encores of the audience. This feature proves such an attraction that it is necessary to disconnect the instruments from the line at frequent intervals in order to disperse the crowd and allow other visitors to take their turn at the receivers.

Altogether the exhibit is pleasing and instructive to the public, and although no charge whatever is made by the Telephone Company, it unquestionably will be remunerated through the greater familiarity with the telephone gained by the public and the consequent increased patronage of its long lines. The exhibit is in charge of Mr. M. H. Howell. Its design and arrangement, etc., were left to the competent hands of Mr. I. H. Farnham, the electrical engineer of the company, and his assistants.

Exhibit of Holtzer-Cabot Apparatus.

IN a very handsome booth, and at a most desirable spot in the Exhibition Hall, the Holtzer-Cabot Electric Company, of Boston, Mass., are showing a very complete line of samples of their numerous well-known telephone appliances. Among these should be mentioned their magneto bells, suitable for all requirements of telephone work, with both cut gears and sprocket chain movement. The latter have a new arrangement in order to insure quiet running. Their bridging magnetos, hand and power generators and extension bells are shown in a great variety of forms and sizes. They also exhibit a large number of power and motor generators belted and direct-connected for a. c. and d. c. circuits.

HOLTZER-CABOT TELEPHONE EXHIBIT, MECHANICS' FAIR. (GENERAL ELECTRIC GLOBE IN BACKGROUND.)

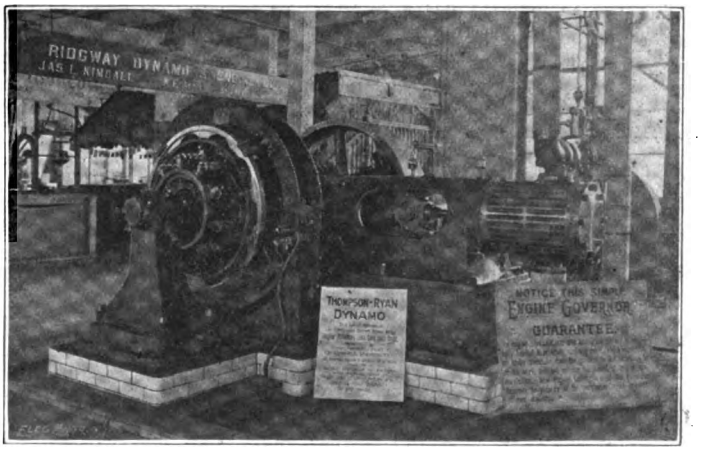
Motors are furnished wound for 52 or 104 volts, large enough to run a 5 magnet special power generator for exchanges of 2,000 subscribers. The company's well-known standard pattern receivers attract a great deal of attention, as even the untutored public are quick to perceive its good qualities. In this receiver a shell of the best hard rubber is used; special magnet steel of fine quality; malleable iron nickel-plated tip; and polished boxwood, silk wound spool. The shell is of sufficient thickness to insure its not varying materially under changes of temperature so as to affect the adjustment, a common defect inherent in cheap shells. They also show their watch case, pony, head, spoon handle and metal shell receivers, the last of which is not affected by a change of temperature. The company also exhibit the well-known Ness automatic intercommunicating telephone system for warehouses, hotels, private residences, offices, schools, etc. One of the admirable features of this system is the employment of an automatic switch, which, after the receiver has been replaced, flies back to its own point. To call up, the switch lever is simply turned around until it rests upon the point of connection with the instrument it is desired to call. A slight pressure upon the switch knob rings up the bell of the instrument, and when the conversation is finished the replacing of the receiver returns the switch to its own point. It is not necessary to first remove the receiver in this system before making a call. This switch is well constructed mechanically, and all the working parts which are liable to wear are of "Stubbs" steel and case hardened.

The Ness automatic desk set is also shown and diagrams of connections are distributed.

In the motor line the company are making a very creditable showing. They recognize the importance of dynamos, motors and motor-generators in telephone exchanges and manufacture these machines to run on any electric light and power circuit, direct or alternating, and capable of delivering current suitable for charging storage batteries, operating ringing and test circuits, selective signals, etc. They exhibit multipolar and bipolar types, rotary transformers, desk and bracket fans, alternating current power motors, self-starting under full load from ⅛ to 1½ h. p., electric window turn tables, sewing machine clamp motors, plating machines, automatic pressure controller, gas engine igniters (a very complete and ingenious arrangement) and a direct-geared, motor-driven bandage winder for hospitals. In another section of the exhibit they show miscellaneous apparatus, such as burglar alarm bells, watchman's clocks, gongs for fire alarm and other purposes, a new style French pattern annunciator, 2 station indicator bell, gas lighting cut-outs and a new circuit closing attachment. The company's works are located at Brookline, Mass., and their business is constantly on the increase.

The Ridgway Dynamo and Engine Co.'s Exhibit.

LOCATED in the basement of the large Mechanic Building, and made conspicuous by its silence in operation, is the generating unit exhibited by the above company, successors to J. H. McEwen Manufacturing Company, of Ridgway, Pa., builders of the McEwen engine and the Thompson-Ryan generator. The exhibit consists of a 75 kilowatt 125-volt Thompson-Ryan generator, direct connected to a 14x14 horizontal, automatic McEwen engine, running at a speed of 260 revolution per minute. The prominent features of this engine are its close regulation, flat steam balanced valve, simple crosshead, the roller-pin governor, its freedom from throwing oil and the accessibility of parts. The dynamo possesses some novel modifications, the winding consisting of a plain spiral of copper ribbon wound into the slots between the teeth. There are no flanges on the field yoke to cover the field coils, and the series coil is offset one-half pole angle from the shunt winding, thereby affecting a balance of the distorting effect of the same current in the armature. The machine is fitted with fixed brushes, but is free from sparking and quiet running. It is wired to a switchboard manufactured by the Albert & J. M. Anderson Mfg. Co., fitted with Keystone instruments. The machine furnishes the current for lighting the large signs on the roof of the building, and to a number of the exhibits at the Fair. The exhibit is in charge of



McEWEN ENGINE AND THOMPSON-RYAN DYNAMO EXHIBITED BY THE RIDGWAY DYNAMO & ENGINE CO.

Digitized by Google

Mr. Jas. L. Kimball, the company's N. E. agent, located at 1102 Exchange Building, Boston, Mass.

Fine Telephone Exhibit of Whitman & Couch.

IN a very conspicuous place in the main hall near the Japanese Garden is located the spacious exhibit of Whitman & Couch of 196 Summer street, Boston, Mass., the progressive telephone manufacturers. A great variety of their well known apparatus is shown for use on private lines and for exchanges, as well as the Mason instrument which does away with the pay station operator. They call the attention of city officials and street railway companies to the W. & C. iron box telephones, specially adapted for outside service, such as police and fire alarm systems.

They also show the W. & C. microphone, which is remarkable in efficiency, reproducing articulate speech with perfect roundness and clearness and requiring but a minimum amount of battery. It is claimed not to pack or fry and is of pleasing appearance.

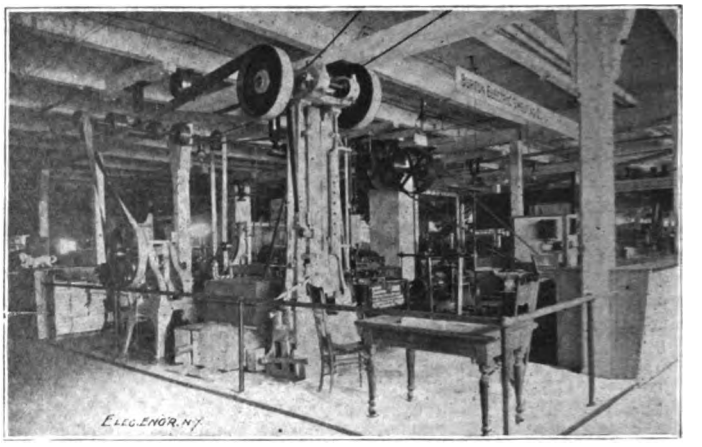
A number of the company's telephone sets, magnetos and receivers are exhibited and are evidence of long experience on the part of the designers and of a good product at a reasonable price. A number of switchboards are exhibited, and the superintendents of schools are invited to investigate the hotel and school systems in actual use with the control station at the exhibit, the company furnishing complete telephone service to the building. There are shown besides a great variety of miscellaneous telephone supplies manufactured by this enterprising company.

WHITMAN & COUCH TELEPHONE EXHIBIT, MECHANICS' FAIR.

Working Exhibit of the Burton Electric Smelting Company.

ONE of the most interesting and complete exhibits at the Fair, and one which attracts the attention of the multitude, is the practical demonstration of electric metal working and smelting by the Burton Electric Smelting Company, 144 Lincoln street, Boston, Mass. There are shown in actual operation four electric liquid forges of 45 h. p., which from time to time have been illustrated in these columns. A 35 h. p. dry process lap welding and forging machine furnishes the required current to heat two bars each 1 inch square and 3 feet long in 4½ minutes. The current generated by this machine is transformed into a heating current of low electromotive force and great amperage, both of which vary according to the size of the piece of metal being heated, say from 4 to 30 volts, and from 6,000 to 10,000 amperes. This regulating device absolutely controls the heat at the terminals of the secondaries of the transformer, and so minutely that a piece of metal can be raised to a white heat and maintained at that point for a great length of time with very little power.

The company also exhibit a drop hammer which stamps out neat little horseshoes sold for the small sum of ten cents and taken home by the visitors as souvenirs of the Fair. A d. c. generator is running, giving a voltage of from 2 to 30 and having a current range of from 1 to 3,000 amperes. It is the first universal machine on the market having such a wide range of voltage and current. There are further shown a metal rolling machine for rolling steel balls and irregular shapes, and the United States electrical leather tanning process, which electrically unhairs animal skins and comprises also extracting and distilling apparatus.



BURTON ELECTRIC SMELTING CO.'S EXHIBIT, MECHANICS' FAIR.

Interesting Exhibits at the Mechanics Fair, Boston.

GENERAL ELECTRIC CO.—The exhibit of the General Electric Company, located near the stairs in Exhibition Hall, consists of their mammoth globe, 25 feet 4 inches in diameter, mounted on a suitable pedestal and representing the earth. The globe, without which no exhibition showing the progress made in electrical engineering and allied industries, would now be complete, and which was exhibited at the recent street railway convention, was illustrated and described in detail in our issue of September 15.

RIKER ELECTRIC MOTOR CO., Brooklyn, N. Y.—To those interested in automobiles, or the horseless vehicles, as they are more commonly called, the exhibit of the Ricker Electric Motor Co. is of special interest. Their line of vehicles on exhibition is being supplemented from time to time during the show, placing in exhibition different vehicles made by this firm, which is in the forefront of the automabile manufacturing business in America. Aside from apparatus for automobiles there are shown tricycles and four-wheel vehicles for both pleasure service and commercial use. Their delivery wagons are in use in New York City by several leading houses, and others are building for prominent business houses in Boston. A number of the company's vehicles were illustrated and described in our issues of Jan. 6 and May 12, 1898.

AMERICAN MOTOR CO., 32 Broadway, New York.—The exhibit of the American Motor Co. comprises gas and gasolene motors for boats, carriages and other vehicles and for stationary use. The American Motor Co. are well-known manufacturers of gas and gasolene engines, of which they make a fine exhibit. It is claimed for these motors that they are the strongest, lightest, and most compact for horseless carriages, boats, and for all stationary purposes. The company are also manufacturers of horseless carriages and horseless carriage parts, and also produce a very satisfactory electric ignition outfit for sparking small motors. This exhibit, which is located in the basement of Exhibition Hall attracts much attention.

POPE MFG. CO., Hartford, Conn., are making an exhibit of their various types of electric vehicles which they manufacture. Naturally, on account of their splendid reputation and the well-earned success of this company, these vehicles are attracting a great deal of attention. They are showing their Marks III. and VI., which were illustrated and described at length in our issues of May 26 and July 28, 1898. The vehicles are taken out of the exhibition hall for a few hours each day and are driven around the city much to the delight of the enterprising and up-to-date

Digitized by Google

Bostonians. This exhibition may effect an early, or we should say late introduction of electric vehicles into Boston.

The Electrical Equipment of the Conkey Printing Establishment.[1]—I.

BY GEORGE A. DAMON.

THERE are few instances where the adoption of electric power has led to a more radical departure from ordinary methods, or where greater advantage has been taken of the possibilities of electric operation, than in the model printing establishment of The W. B. Conkey Company, at Hammond, Ind. This great establishment is the result of more than twenty years' development. Starting with a small capital, Mr. Conkey

FIG. 1.—CONKEY PRINTING PLANT, HAMMOND, NEAR CHICAGO.

gradually increased the size of his establishment until, about a year ago, it occupied the seven-story Franklin Building, on Dearborn street, Chicago, and two seven-story structures on Plymouth Place, besides a large warehouse on Market street. Power was transmitted from the engine fly wheel to the various machines by means of belts, rope drives and pulleys. By actual test fully 45 per cent. of the power delivered by the engine to the main driving shaft, at average load, was used to run the shafting, and this transmission loss was of course much larger at lighter loads.

The new plant is located on a stretch of rolling prairie land and the buildings cover about four acres of ground space. The most unique feature of the plant is the construction of the building (Fig. 1.) It extends over an area of 520 x 450 feet and consists of but one floor. This makes it possible to pay especial attention to the lighting, and as a result the whole roof resembles a vast skylight. The windows of the roof are glazed with frosted glass and are placed at an angle looking toward the north. Every 29 feet of roof space provides 11 feet of light. The entire roof is built up of light structural steel work resting upon cast iron columns spaced on 29 feet centres one way and 16 feet centres in the other direction. The height of the trusses above the floor is 12 feet.

The general and private offices with the employees dining, bicycle and wash rooms, are located at the front of the building. The press room occupies a space 116 feet by 212 feet in the centre of the large structure. The receiving room and shipping room are located convenient to the side track platform, while the plate vault, electrotype room, composing room, store room, and hard and soft bindery surround the central press room. It will thus be seen that the stock passes through the plant with a minimum amount of travel, from the receiving platform to the shipping room. As everything is upon the ground floor no elevators are required. The power plant with its boiler, engine and fan room is located in the north side of the building convenient to the railroad tracks. Coal is delivered from the cars directly into bins in the boiler room.

In the power plant the boilers are of the horizontal water tube type with 3,472 square feet of heating surface and 60 square feet of grate surface per boiler. At the present time but two boilers are installed and the stack is situated so as to eventually be flanked on either side by two boilers of the completed battery of four. The breeching from the boilers to the stack is of sheet steel.

[1]Abstract of paper read before the Chicago Electrical Association.

The stack is a self-supporting steel chimney 125 feet high and 54 inches diameter inside the gas flue. The courses for the first 30 feet from the top are made of 3-16 inch plate; for the next 30 feet of ¼ inch plate; for the following 40 feet of 5-16 inch plate; while the 25 feet coned base is made of ⅜ inch plate. The stack is held in place by eight 1⅞ inch bolts bedded in a foundation of concrete. A unique feature of the stack is the method used of inverting each section so that the top end of each section rests outside the section immediately above it. This prevents the soot washing through the joints and down the outside of the stack, as is too frequently the case with steel chimneys. The engine, shown upon the left end of the row of generating machinery, is an 11½ x 18 x 36 inch tandem compound non-condensing Corliss engine, and runs at 125 revolutions per minute. This speed is rather high for a Corliss engine, but indicates the tendency of modern practice where the engine is directly connected to a generator.

This engine is fitted with double eccentrics and governors on both cylinders, the governor being of the Porter type. The special design of the double ported admission valves permits a long range of cut-off while the operation of the steam and exhaust valves by separate eccentrics gives the engine a long range of cut-off and large reserve for overloads. The flywheel is made in halves, weighs 16,000 pounds, and is 12 feet in diameter, giving a peripheral speed of 4,700 feet per minute. With 120 pounds initial steam pressure and a back pressure of 3 pounds, the engine is rated at 160 i h p, and is guaranteed to develop each indicated horse power hour on a consumption of 21 pounds of steam. It has an economical range of power between 100 i. h. p. and 225 i. h. p., but is designed in all its parts to operate continuously on an overload of 100 per cent., or at 320 i. h. p. Provision has been made in the piping to secure this overload by admitting high pressure steam to the low pressure cylinder. The shaft of the engine is of open hearth forged annealed steel. It projects through the outboard bearing a sufficient distance to carry a flange forged solid on the end of the shaft. The flange is to carry a coupling which connects the engine shaft to the generator shaft.

The generators are compound wound and are designed to deliver 100 k. w. output at 225 volts when running at 125 revolutions per minute. The field frame is split through the center on a horizontal plane so that the upper part can be removed.

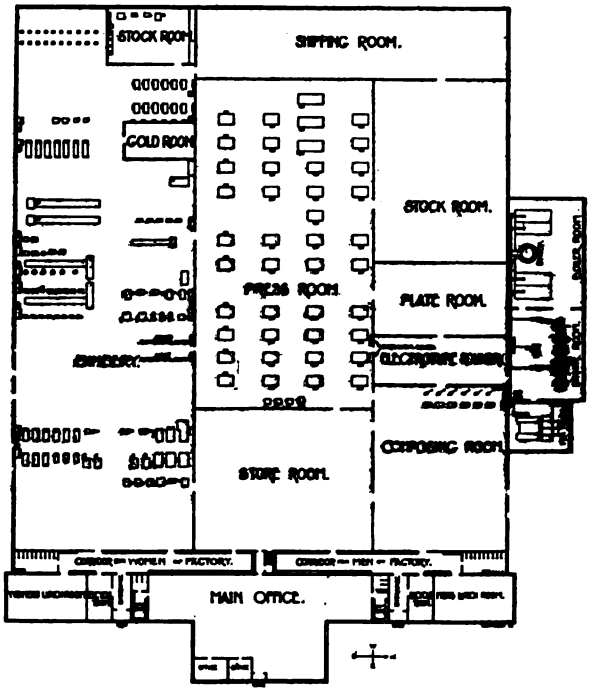


FIG. 2.—PLAN OF BUILDINGS AND ELECTRIC POWER PLANT.

This operation will not be necessary, however, in case repairs are required on the armature windings or field coils, as provision has been made to slide the entire armature frame parallel to the shaft, along cast iron footings, a sufficient distance to clear the armature. The armature is of the ironclad type with a commutator of ample proportions. The field frame has eight poles

Digitized by Google

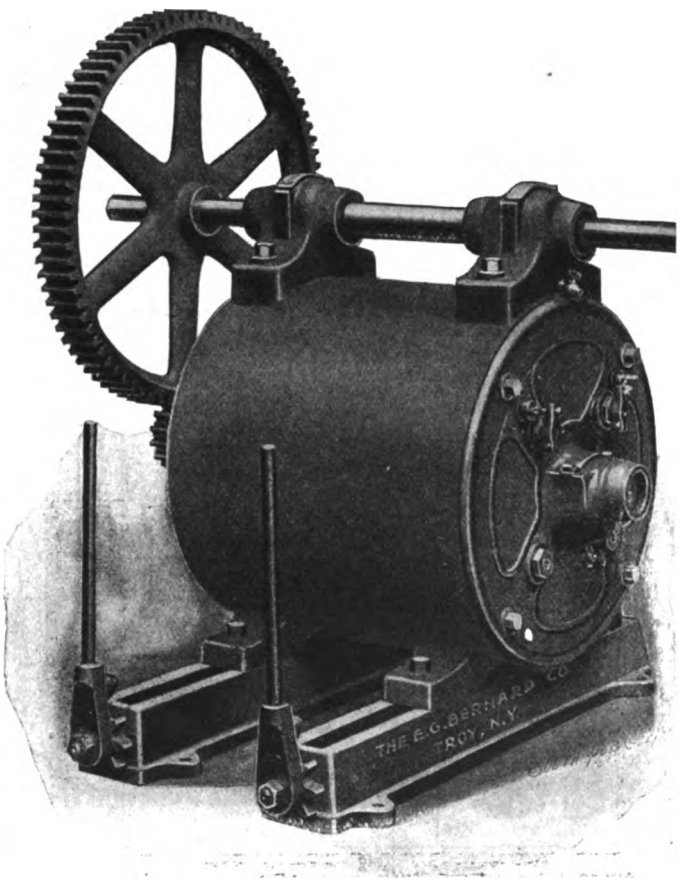
and the compounding coils are provided with an adjustable shunt so that the over-compounding may be adjusted over a range of from one to five per cent.

The arrangement of the machinery in the power plant is shown in Fig. 2. It will be seen that this plan calls for two engines and three generators. The second engine is also a tandem compound non-condensing engine, but is of the centre crank type with overhanging flywheels. This engine is of twice the horse power of the side crank engine, that is it can develop sufficient power to operate economically two of the 100 k w generators, though when necessary it will be able to operate all three of the generators.

Bernard Enclosed "Barrel" Motors and Generators.

THE E. G. Bernard Co., of Troy, N. Y., are busily engaged in manufacturing and installing enclosed apparatus of the "barrel" type, as shown by the accompanying cut. The various improved details, excellence of workmanship and high grade of material have resulted in the production of machines which are claimed to be unsurpassed. They are especially adapted for direct connection to shafting machinery, elevators, pumps, exhaust fans, etc., and for all places where moisture exists or economy of space is desired. They are built for all voltages and speeds, and are excellent for launch or steamer lighting, when direct connected to vertical high speed engines.

A recent installation has been that at Dobler's brewery, Albany, N. Y. Two 5 h. p. motors were placed in a very wet racking and cleaning room. One is fastened on the ceiling and belted to a washer; the other on a post and geared with sprocket wheel to a keg hoist. One 5 h. p. is direct connected to a beer pump and placed in the refrigerating cellar. One 3 h. p. is placed in the open air, for operating washing machines. One 15 h. p. is direct connected to a Graves elevator. In addition to these, are two direct connected generating units, one of 16 k. w., the other of 35 k. w.



BERNARD NEW ENCLOSED MOTOR.

PERSONAL

MR. J. H. HALLBERG, E. E., of the Standard Thermometer Company, is to be married on November 16 to Miss Mary Ellen, daughter of Mr. and Mrs. M. M. Daley, of Salem, Mass. For some time past, Mr. Hallberg has been in charge of the arc lighting expert work of the company and has made himself generally known by some excellent contributions to the literature of the subject.

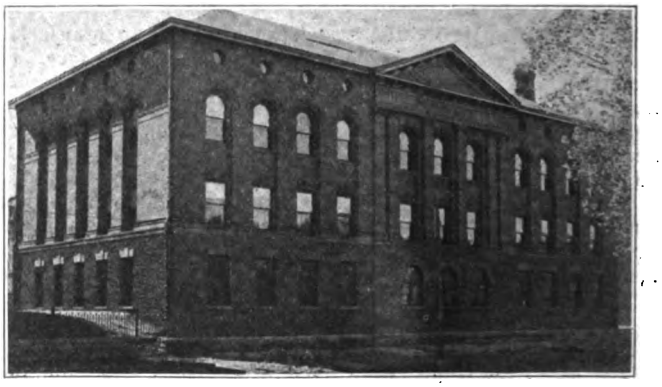
Mr. C. O. BAKER, JR., of platinum fame, has just been welcomed home by his many friends after a long European trip this summer. Mr. H. L. Shippy, who was also a visitor to the other side, was his companion on the homeward journey.

MR. JOSEPH LEITER has been principal in negotiations for the purchase of the Rhode Island Locomotive Works, Providence, and it is said the deal will go through or is completed. It is further reported that other specialties will be turned out, meaning electric motors and locomotives. Mr. Leiter is one of the directors of the Chicago Edison Co. and takes a lively interest in electrical matters.

EDUCATIONAL

New Mechanic Arts Hall, University of Nebraska.

THE new building at the University of Nebraska, called the Hall of Mechanic Arts, was formally dedicated with impressive ceremonies on Oct. 28. The new professor of electrical engineering, Mr. Morgan Brooks, was inducted into office during the exercises and then made an admirable address on "Electricity and Enlightenment," in which he reviewed with great skill and felicity the march of electrical progress and suggested the conditions of the future.



THE NEW HALL OF MECHANIC ARTS, UNIVERSITY OF NEBRASKA.

The appropriation for Mechanics Arts Hall by the State of Nebraska was $30,000, and the total cost as the building stands has been $30,126. So far, only the north wing has been finished, or not quite half of the entire complete structure. The Electrical Engineering Department has fine rooms in the new building, occupying space on two floors, including an office, two lecture rooms, a laboratory and a photometry room. The department also retains its space in the old laboratory, which contains the lighting plant of the University as well as all the experimental dynamos, etc. An article fully descriptive of the equipment as then existing appeared with several illustrations in The Electrical Engineer of March 25, 1896, since which time a steady growth has been enjoyed. Governor Holcomb opened the building with appropriate ceremonies and a memorial tablet was unveiled.

Digitized by Google

OBITUARY

Charles H. Summers.

Charles H. Summers, chief electrician of the Western Division of the Western Union Telegraph Company, at Chicago, died suddenly of heart failure on Nov. 2 in San Francisco. Mr. Summers was on the Pacific Coast on a trip combining business and pleasure. He had traveled over and inspected the telegraph company's Western lines so often that he carried a map of the great system of lines and offices in his mind, and this familiarity enabled him to decide at once upon all matters referred to his department.

Mr. Summers had some rare experiences in the line of duty. He was blown up on a steamboat on the Ohio River, captured by the Confederates, shot by the Mexicans on the Texas border, and blown up in an underground manhole in the streets of Chicago, but to the end he kept attending to business as usual. Mr. Summers had a large acquaintance among the prominent men of the country, and was perfectly at home in any part of the Western country. He was a man of excellent judgment in all matters connected with his business, and was very much endeared to all the officers of the Western Union Company.

Henry Flint Dennis.

The death is announced of Mr. Henry F. Dennis at the age of 31, at the city of Bracebridge, Ont., of which he had become city engineer. He was formerly with the Thomson-Houston Company and was connected with the systems at Syracuse, N. Y., Burlington, Vt., Toronto, Can. He was a hard student and a man of considerable inventive ability. He was a native of Portland, Me.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued October 25, 1898.

Alarms and Signals:—

ANNUNCIATOR. O. Wiederhold, Summit, N. J., 612,885. Filed Oct. 2, 1897. Embodies an armature formed up from sheet metal and provided with a recess in its side conforming in shape to the magnet-pole with which the armature is to be used, and a thin wall bounding the recesses and extending at an angle to the face of the armature and adapted to be acted on by the magnet.

INDICATION BOX FOR SWITCHES. J. B. Struble, Wilkinsburg, Pa., 612,979. Filed March 1, 1898. Comprises two contacts forming terminals of switch-indicating circuits, two movable contact-blocks for closing the circuits, means for shifting one of the blocks before and the other after the shifting of the switch-rails, and means for locking the blocks when shifted.

Conductors, Conduits and Insulators:—

ELECTRIC CONTACT BOX. J. N. Thomas and W. Milton Brown, Johnstown, Pa., 612,880. Filed March 22, 1898. Comprises a closed insulating vessel containing a switching mechanism, an electrode on each side of the top wall of the same, a conductor connecting the electrodes, and cushions between each electrode and the top of the vessel.

Distribution:—

ELECTRIC CURRENT LEVELER. M. Hutin and M. Leblanc, Paris, France, 613,205. Filed Dec. 16, 1897. Composed of a core built up of parallelopipeds separated from each other by material of low magnetic permeability, a yoke closing the magnetic circuit of the core, a metal spool on the core, and a primary winding upon the spool.

Dynamos and Motors:—

ARMATURE WINDING. A. L. Riker, New York, 612,977. Filed Nov. 19, 1897. The coil is of hexagonal form, composed of any desired number of turns of round wire, those portions projecting beyond the end of the armature-core occupy substantially the same plane as the parallel sides of the coil which lies in the slots of the core.

ELECTRIC FAN. D. L. and R. H. Bates, Dayton, O., 613,054. Filed July 21, 1898. Embodies a special oil-cup and a sleeve upon which the armature commutator and fan-blades are carried in fans of the ceiling and column type.

DYNAMO ELECTRIC MACHINE OR MOTOR. S. G. Brown, London, England, 613,116. Filed April 9, 1898. A field magnet for a dynamo or motor comprising an outer portion having an extended pole-face, an inner portion magnetically distinct from the outer portion and having a contracted pole-face and means for exciting the two portions.

ALTERNATING CURRENT ELECTRIC MOTOR. A. S. Frazer, Tynemouth, England, 613,135. Filed Dec. 28, 1897. Details of construction.

ALTERNATING CURRENT MOTOR SYSTEM AND METHOD OF OPERATING SAME. M. Hutin and M. Leblanc, Paris, France, 513,203. Filed April 10, 1897. A method of starting a single phase alternating current motor from rest under load which consists in supplying multiphase electromotive forces to the circuits of its induced windings from an external source.

ALTERNATING CURRENT ASYNCHRONOUS MACHINE. M. Hutin and M. Leblanc, Paris, France, 613,204. Filed May 4, 1897. A mode of impressing a wave of electromotive force on any circuit which consists in connecting the circuit to the brushes of a generator of the direct current type, and separately exciting the field of the latter in accordance with the wave desired.

ALTERNATING CURRENT DYNAMO ELECTRIC MACHINE. M. Leblanc, Paris, France, 613,209. Filed April 10, 1897. A method of operating an electric motor which consists in supplying its field magnet windings with direct current and its armature with alternating currents through the same line.

Lamps and Appurtenances:—

ELECTRIC LAMP GUARD. H. M. Underwood, Chicago, Ill., 612,999. Filed Aug. 19, 1897. Wire guard for incandescent lamps.

Miscellaneous:—

ELECTRIC FURNACE. L. Bresson, Lyons, France, 612,943. Filed Feb. 8, 1898. An oscillating electric furnace to be used for the production of calcium carbid.

THERMOSTAT. W. E. Facer, Cleveland, O., 613,062. Filed Nov. 4, 1897. Comprises a thin metal receptacle filled with an expansible liquid, and having two flexible discs forming parts of its wall, and means to complete an electric circuit through the discs on the expansion of the liquid.

APPARATUS FOR PRODUCING RADIATION OF ELECTRICITY. C. H. Stearn and C. F. Topham, London, England, 613,090. Filed Dec. 20, 1897. X-ray tube.

CIGAR LIGHTER. A. C. Gruhlke, Waterloo, Ind., 613,140. Filed Jan. 19, 1898. Details of construction.

RAILWAY SIGNAL. W. Andrews, London, Eng., 612,810. Filed Dec. 20, 1897. Two or more independent indicators on the locomotive are operated through a single conductor along the line by employing currents of different strengths.

Railways and Appliances:—

TROLLEY STAND. W. T. Shryockm, Allegheny, Pa., 612,875. Filed July 20, 1897. Provides a means whereby a trolley when it leaves the wire will trip itself and lessen the tension on the spring and permit the pole to descend a sufficient distance so it will be clear of obstacles.

INSULATOR AND HANGER FOR ELECTRIC RAILWAYS. W. C. Keithly, San Francisco, Cal., 612,929. Filed Jan. 26, 1898. Details of construction.

UNDERGROUND ELECTRIC RAILWAY. G. W. Smith, St. Louis, Mo., 613,084. Filed May 28, 1898. Employs a flexible tube in which is contained the conductor and means for making contact with the trolley consisting of contact shoes and a lever fulcrumed to the car platform to raise the flexible tube.

UNDERGROUND ELECTRIC RAILWAY SYSTEM. F. D. Robb, Hot Springs, Ark., 613,175. Filed July 2, 1897. The conduit is formed in sections of any length, is oval in cross section, with its lower end contracted to form a drain, which is lined with porcelain and connects with the sewer.

SAFETY DEVICE FOR SUSPENDED CONDUCTORS. J. N. Thomas, Johnstown, Pa., 613,177. Filed Jan. 20, 1898. A sectional system of wiring for overload trolley railways.

TROLLEY POLE. J. Walsh, Elyria, Ohio, 613,181. Filed Nov. 2, 1896. Comprises a pivoted trolley pole provided at its upper end with a sliding rod movable transversely with relation to the trolley pole, and a rotatable trolley wheel carried by the sliding rod and through which the rod extends and which is incapable of longitudinal movement.

Regulation:—

METHOD OR MEANS FOR SYNCHRONIZING. M. Hutin and M. Leblanc, Paris, France, 613,206. Filed Dec. 30, 1897. Comprises a method of and apparatus for impressing upon a circuit an electromotive force proportional to a given periodic electric current.

Switches, Cut-Outs, Etc.:—

AUTOMATIC LEAK OR GROUND CUT-OUT. W. L. Pratt, Adams, N. Y., 613,046. Filed May 20, 1896. Comprises a hinged arm, a loop connection carried thereby, a double armed fuse-wire normally in circuit holding the arm, a branch circuit to ground, condensers and a magnet included in the branch circuit and an armature adapted to face the fuse-wire, when the leakage of current has sufficiently accumulated in the condensers so that a discharge to ground will occur.

ELECTRIC SWITCH. W. Ely, Providence, R. I., 613,128. Filed Sept. 5, 1896. A knife switch in which the make and break is assisted by springs.

ELECTRIC SWITCH. W. Ely, Providence, and W. B. Bernardini, Lakewood, R. I., 613,129. Filed July 29, 1896. Similar to above.

Telegraphs:—

TELEGRAPHY. C. D. Royse, Greencastle, and W. A. Royse, Indianapolis, Ind., 613,080. Filed Aug. 11, 1897. System of telegraphy between fixed stations and moving trains.

Telephones:—

TELEPHONE EXCHANGE SYSTEM. C. S. Heilman, Philadelphia, Pa., 613,036. Filed Nov. 21, 1896. Details of construction.

Paris Expostion Data.

The admission to the 1900 Exposition will be one franc (20 cents). It is estimated that 60,000,000 francs, or $12,000,000, will be received from the admissions in 1900. It is now estimated that the total expenses of the Exposition will be 106,785,000 francs, or $21,354,000.

Out of the 55 countries that have been invited to participate in the Exposition, Egypt is the only country that will not take part. The Commissioner General of the United States, Hon. Ferdinand W. Peck, says, "That the struggle for supremacy at the Exposition of 1900 will be a friendly one between nations,

Digitized by Google

and not an industrial competition between manufacturers of the same nationality." Commissioner General Peck will organize the exhibits of the United States on these lines.

TRADE NOTES AND NOVELTIES

The Hanchett Direct Reading Ohmmeter.

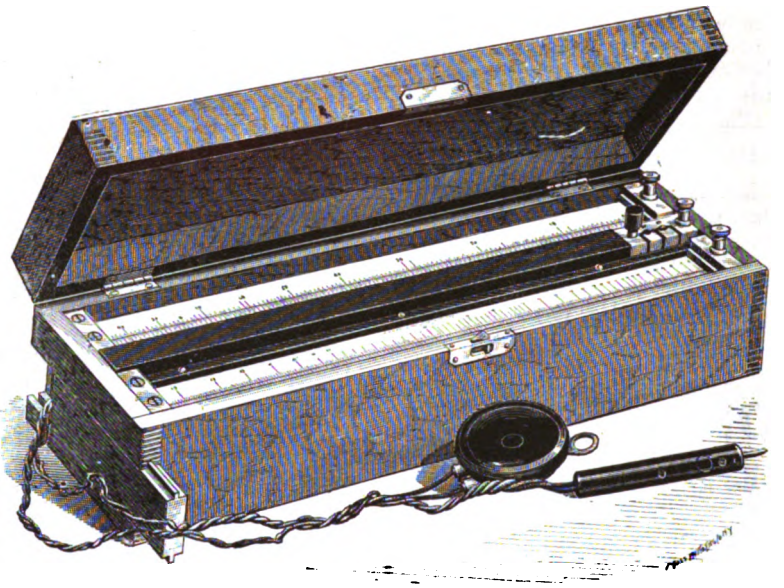
A NEW measuring instrument has been recently placed upon the market and is illustrated in the accompanying cut. It may be briefly described as a commercialized slide wire bridge, but it possesses many improvements over that instrument as it is commonly found in laboratories. A smooth, straight wire of a special alloy is stretched over a scale which is graduated to read directly in ohms. The unknown resistance is connected across two binding posts at the end of the scales, which are marked X. At the other end of the case a small pocket is provided which contains a stylus and a telephone receiver. A small battery key is imbedded at the lower end of the stylus, as shown in the illustration. In determining the unknown resistance the telephone receiver is held to the ear and the stylus is held in the hand in much the same manner as a pen, the forefinger serving to depress the battery key. A point is sought along the slide wire which, when touched with the stylus, there will be no click in the receiver. This is very rapidly found, because the click becomes fainter and fainter as the point of silence is approached and ceases entirely when it is reached. After measuring one or two resistances, the novice will have no difficulty in finding the resistance in as short a time as fifteen seconds. This is far more rapid than the operation of the ordinary testing set, for in this instrument a single touch of the stylus on the wire corresponds in the testing set to an adjustment of the plugs, a pressure of the galvanometer key and a wait until the needle has come to rest. The scale of the instrument is lettered in three colors, black, red and blue; and a small plug is provided at one end of the bridge which fits into three holes colored to correspond. It is obvious that this plug is inserted in the hole which is marked with the same color as that of the scale which it is desired to use. The three scales give the instrument a wide range, from one thousandth of an ohm to fifty thousand ohms, which covers any commercial resistance excepting insulation resistances.

Insulation resistances cannot be measured with accuracy with such a low voltage instrument as a testing set, and, therefore, the range of this instrument has not been extended to include them, though the manufacturers are prepared to supply instruments of higher reading on special order.

The telephone receiver renders the instrument independent of vibration, stray magnetic fields and other influences which make the ordinary testing set useless and which abound in dynamo rooms, repair shops and all other places where practical testing is done and a good commercial instrument for measuring resistance is desired.

The instrument carries its own battery, which is adapted to be readily removed and replaced by anyone and can be done at the expense of $1.50, which is a marked advantage when the high price of chloride silver cells, which are used for ordinary testing sets, is considered. Should the battery fail after long and continued use and it be not convenient to renew it at once, connection can be made with any convenient battery to the two outer binding posts at the end of the bridge and the bridge used as before with the simple omission of depressing the battery key; indeed, an electric light circuit of 110 volts with a lamp in series can be used for this purpose.

The instrument is sold for a very low figure considering its quality, which is of the best. It is made of polished mahogany with trimmings of polished hard rubber, and the brass work is accurately machined and lacquered. The scale is printed from specially engraved plates, and the combination of colors is carefully chosen so as to avoid fatiguing the eye. It has just been placed upon the market by The American Electric Specialty Company, 123 Liberty street, New York City.



THE HANCHETT DIRECT READING OHMMETER.

High and Low Frequency Single Phase G. E. Alternators.

THE General Electric Co. manufactures alternators of 60 and 125 cycles frequency in both revolving armature and revolving field types. Revolving armature machines of 125 cycles frequency are built in five standard sizes, 30, 60, 90, 120 and 130 kilowatts, each size wound for 1,040 or 2,030 volts. The low periodicity alternators are wound for 1,040, 2,030 or 3,120 volts, and are built in capacities of 60, 90, 120, 130 kilowatts. All are arranged for belt driving, and are set on rails.

The fields are both separately and self-excited, part of the main current being rectified for the self-excitation. The current for the separate excitation of the fields is derived from a small direct current generator driven by belt from a pulley on the end of the armature shaft. The two windings allow of adjustment of the fields to automatically compensate for changes of load, thus giving a practically constant potential at the terminals. The machine may also be over-compounded to compensate for line loss.

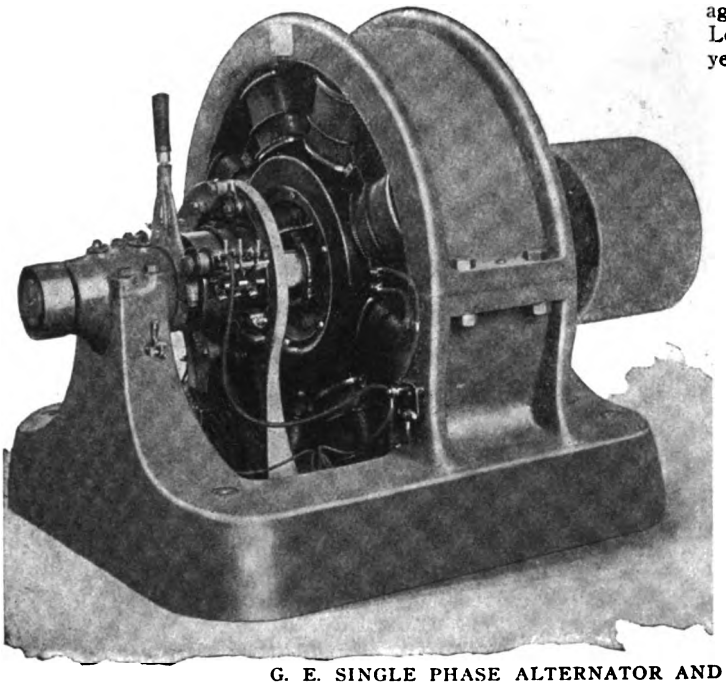
The degree of compounding is regulated by a shunt mounted against the inside of the pillow block at the collector end. It is properly adjusted when the machine is under test at the factory.

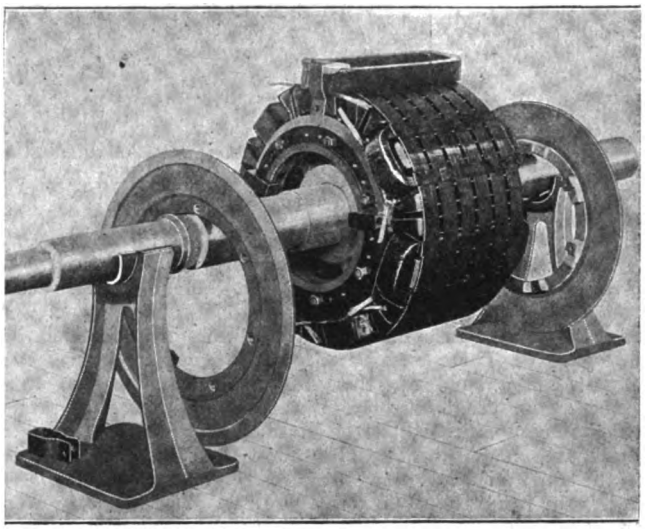
The magnetic field includes part of the frame, which is a cast-

Digitized by Google

iron ring with inwardly projecting poles of laminated iron. By this means eddy current losses are reduced and the reluctance of the magnetic circuit diminished. Both separate and series field coils are wound upon removable spools, the winding of double covered copper wire being carefully insulated from the spools themselves.

The armature is ironclad with laminations of soft steel built up on a cast-iron spider from the core, and each shunt is carefully japanned before assembly. To guard against eddy currents, thin paper sheets are interposed between adjoining plates at frequent intervals. The core is thoroughly ventilated by air drawn through the spider and circulating in the ventilating spaces between core and windings. The coils are wound on forms and thoroughly taped and insulated before they are placed in the core, in which they are secured by insulating blocks. They are supported at the end by saddles of light metal, which give ample support to avoid injury by centrifugal force. This method allows of ready removal of any coil when necessary.





G. E. SINGLE PHASE ALTERNATOR AND HIGH PERIODICITY ARMATURE.

Commutators and collectors are of copper of the highest conductivity and are mounted on a metal hub keyed to the shaft. The insulation consists of mica and hard rubber so arranged that short circuits and grounds are practically impossible. The collector brush holders are supported on a cast-iron standard and insulated from it by hard rubber bushings. The commutator brush holders are supported on a yoke carried by the adjoining pillow block. The bearings are spherical and self-oiling, self-centering and self-aligning, and of ample length to ensure cool running.

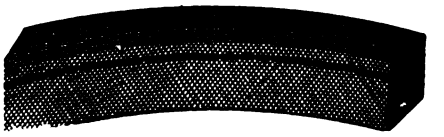
Each alternator, before shipment, is subjected to most thorough test. The insulation of the separately excited field coils is tested to 3,000 volts alternating and the series coils and armatures at pressures at least double the normal operating voltage.

Telephone Apparatus of the Eureka Electric Company.

THE ever-increasing demand for first-class telephone apparatus and the general revival of business has induced men well equipped with a knowledge of the telephone business and its delicate apparatus to enter that very promising field as manufacturers and dealers in supplies. One of the most recent firms organized for this purpose is the Eureka Electric Company, 157-159 South Canal street, Chicago, Ill. The company's salesrooms are very conveniently located opposite the Union Station, and in their stockroom they will carry at all times a large and complete stock of the best telephone apparatus. The line will consist of long-distance apparatus, exchange telephones, interior telephones, switchboards, both self-restoring and hand types, at low prices considering the quality of the goods. A new lightning arrester and distributing board will be among their specialties, including an improved form of cable box, as well as an efficient type of bipolar receiver. All of their instruments are equipped with the Williams magneto, containing the Williams single-core ringer magnets. In transmitters they make the Bell solid back as well as the Ericsson type, both of which they guarantee for two years, and will replace free of cost any not satisfactory. They will also make a testing resistance box for telephone engineers. Besides being well equipped with a line of modern machinery, which enables the company to turn out any kind of special work at short notice, the officers of the company, through their long experience in the telephone field, are eminently well fitted for the designing and manufacturing of first-class telephone apparatus. The president, Mr. I. J. Kusel, and the secretary, Mr. H. J. Kusel, have had years of practical experience in the business, and have a wide acquaintance among the trade. Mr. I. J. Kusel entered the telephone field some years ago as president of the Missouri Telephone Company, of St. Louis, and built up quite a profitable business. For the last two years he represented the American Electric Telephone Company as general salesman, while his brother, Mr. J. H. Kusel, filled a similar position with the Stromberg-Carlson Company.

Goodsell's "98" Pump Packing.

A HIGHLY efficient packing material has recently been placed on the market by the Goodsell Packing Company, 33 South Canal street, Chicago, Ill., and is claimed to possess some very decided advantages over other types. By the process of manufacture employed by this company all tendency or possibility of splitting is successfully overcome by wax end stitching, which can be seen in the figure. This stitching passes through the plies throughout each coil, adjacent to the wearing edge, parallel with it. The '98 pump packing is said not to separate or flake in oil or ammonia, even if the friction is destroyed by these agencies. The packing is made in sizes ranging from ½ to 1 inch in thickness and in coils of 15 feet. A catalogue describing this packing is issued by the company and will be sent to anyone on application.



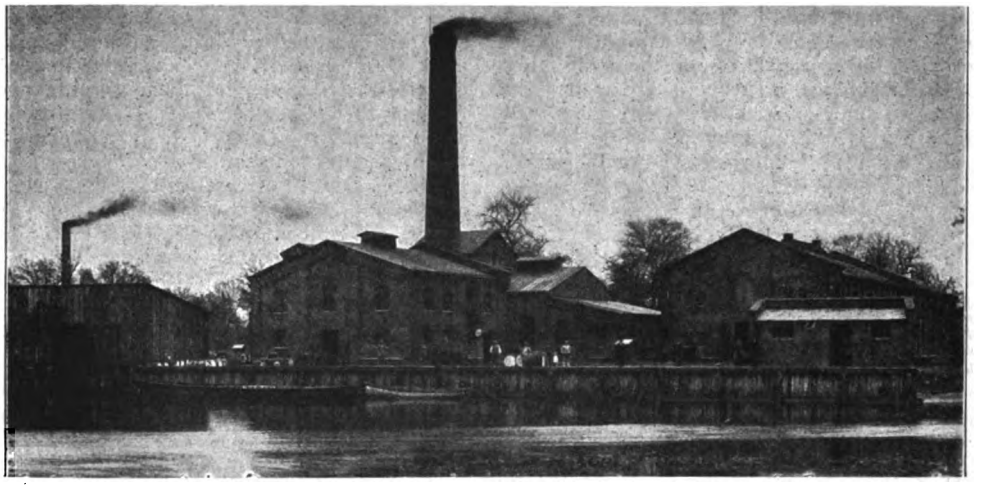
GOODSELL'S '98 PUMP PACKING.

SANDS ELECTRIC CO. has been formed at Cleveland, O., with $10,000 capital stock, by L. Sands, E. Velhagen, F. B. Skeels, C. R. Hunt and O. A. Bejck, to make electrical apparatus.

Digitized by Google

Standard Paint Factory at Hamburg, Germany.

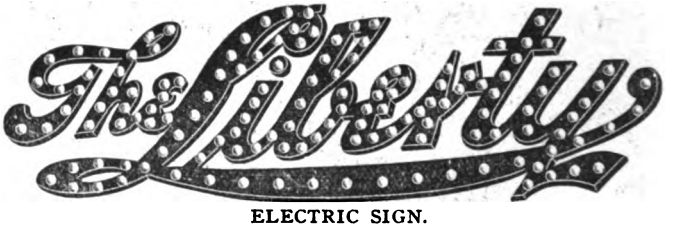
THE European factory of the Standard Paint Company, of New York, the erection of which was begun last July at Hamburg, Germany, was completed in February of this year, and the products that are being manufactured by the Standard Paint Company at their American works are now also regularly manufactured at Hamburg and are being supplied to all parts of Europe from that point. The president of the company, Mr. Shainwald, has devoted a great deal of time and attention to the establishment of the European works, and states that there is very great activity in all electrical interests in Europe, with a consequent very large demand for all grades of the P. & B. products abroad. There are especially large demands for the P. & B. electrical compounds and the P. & B. tape and armature varnish; these are in use by nearly all the leading manufacturers and traction companies in all the European countries. There is a great amount of work going on in street traction, especially in the cities of Great Britain and Germany. Italy is also coming to the front rapidly in these interests. The Hamburg Works are manufacturing the same goods as the main factory in this country, not only those which pertain directly to the electrical trades, but also the P. & B. Ruberoid roofing, P. & B. building, sheathing and insulating papers and P. & B. preservative roof and structural paints. It is highly encouraging to note this further extension of American manufacturing interests in the Old World.



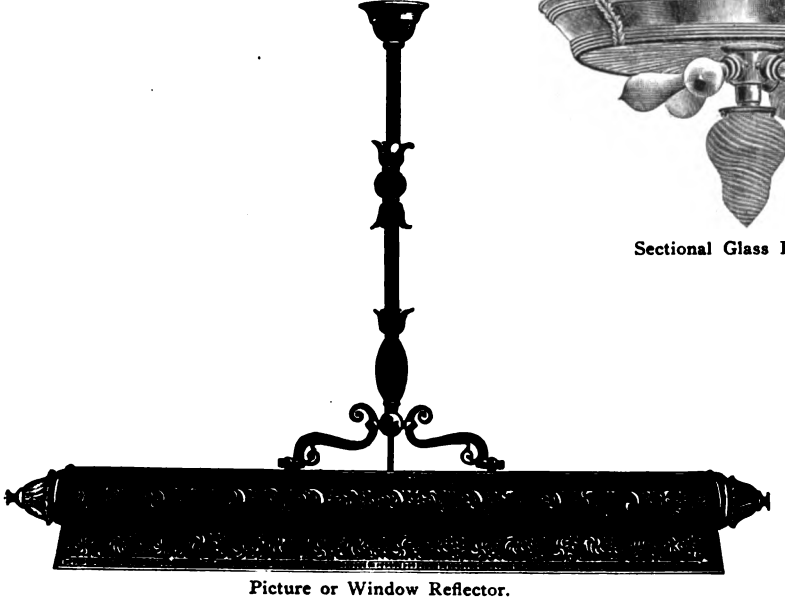
NEW FACTORY OF THE STANDARD PAINT COMPANY, HAMBURG, GERMANY.

Frink's Patent Reflectors.

QUITE in line with the wider introduction of the incandescent lamp and the reduction of prices charged for current, there has gradually been developed an industry which will add its share to the greater usefulness and popularity of the lamp itself. It is the business of reflectors to which we refer, which has been subjected to a great deal of study and finally has been brought to a state of great perfection. One of the foremost pioneers in this line has been Mr. I. P. Frink, 551 Pearl street, New York, who has during the last few years placed on the market a large line of electrical reflectors for a great variety of uses. In fact he has made church and public hall lighting a specialty for forty consecutive years and does not and never will make cheap goods. His reflectors are custom-made with angles adapted to their work. They are harmonizing, fit in

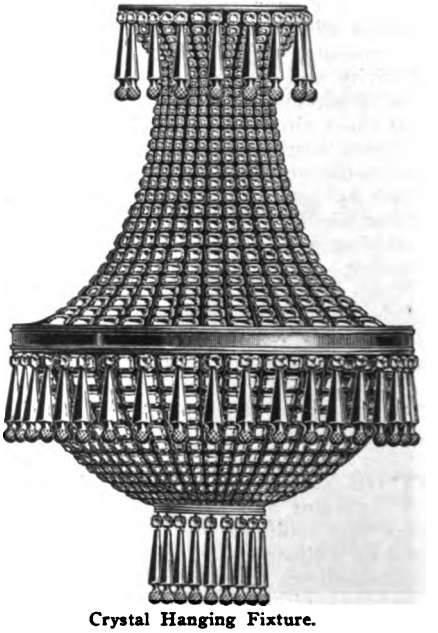


ELECTRIC SIGN.



Picture or Window Reflector.

Sectional Glass Reflector.



Crystal Hanging Fixture.

VARIOUS APPLICATIONS OF FRINK'S PATENT REFLECTORS.

Digitized by Google

looks and fit in work. They are made of the best crystal corrugated glass of double silver plate coated on the back with heat and moisture proof cement. In a catalogue recently issued by Mr. Frink over 600 styles and sizes of reflectors for different purposes are enumerated, four of which are illustrated herewith. One is the picture or window reflector, for lighting pictures or store windows where elaborate furnishings are desired. This reflector is made up on special angles; it gives a thorough and even diffusion of the light directed just where wanted. The sectional glass reflector shown on page 474 has a brass corona and is intended for banks, offices and public buildings, stores and general use. Among the very handsome hanging fixtures which Mr. Frink has designed, the one shown is a fair example. It is very elaborate, richly trimmed with cut-glass prisms and prismatic chains, making a particularly effective electric fixture. The department of electric sign lighting has also received due attention, one type developed being illustrated. Mr. Frink also deals in Parisian novelties, namely incandescent lamps covered by handsome silk flowers of various colors and designs. In fact, his products are too numerous to mention here, but his catalogue will be sent to any one on application and will give any interested person a good idea of the wide field which Mr. Frink has covered.

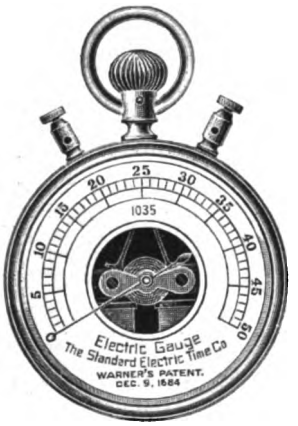
Independent Telephone Meeting.

A special dispatch from La Crosse, Wis., of Oct. 28, says: Proceedings have just leaked out of a secret meeting of the anti-Bell companies' representatives in Winona, Minn. Every independent telephone toll line company in Western Wisconsin and Southern Minnesota was represented and a pooling arrangement entered into that will make a stronger alliance than ever before of anti-Bell interests in this section of the country. In some instances there will be a material reduction of rates, though managers are not ready to announce their new schedules.

Warner Pocket Battery Gauge.

THE illustration below shows the latest form of the well-known Warner pocket battery gauge manufactured and sold by the Standard Electric Time Co., Waterbury, Conn. This gauge is intended for testing the current strength of both open and closed circuit batteries, and is set to indicate the condition of single cells.

It is not arranged to give the current strength or electro-



WARNER'S POCKET BATTERY GAUGE.

motive force only, but a combination of both. Its resistance is about 10 ohms, making a medium through which most batteries should work to obtain the best results. This gauge is set to indicate the current of one cell of battery at a time, and no more should be connected to it.

The figures on the scale are for comparison only, but the gauge is adjusted to read about as follows: One cell of gravity battery should indicate about 25 on the scale, or 1 volt, and two cells about 50, or 2 volts. One cell of Leclanche battery should show from 35 to 40, or about 1.4 volts. On account of the low resistance of the gauge, batteries with a normal voltage and high internal resistance will not show their true value.

The gauge is of great importance to any one using or caring for electric batteries. It is made in office size with a dial 3½ inches in diameter, and in pocket size for telephone inspectors, with a dial 1¾ inches in diameter.

Over 5,000 of these gauges are in daily use, some of the purchasers being the N. Y. & N. J. Telephone Co., Southern N. E. Telephone Co., Mass. T. & T. Co., Central N. Y. T. & T. Co., Chicago Telephone Co., Missouri & Kansas Tel. Co., Wisconsin Tel. Co., Bell Telephone Co., of Canada, and others.

Bell Telephone Output.

The statement of the output of instruments by the American Bell Telephone Company for the month ending Oct. 20 shows the largest gross and net output ever made in any month of the company's history. The net addition to number of instruments in licensee's hands exceeded last May, heretofore the record, by 1,323, and the total gain is very large, 21,816 for the month, and 158,281 for the first ten months of 1898. Figures follow:

October—	1898.	1897.	1896.	1895.
Gross	33,639	23,131	14,766	14,969
Returned	11,823	7,145	7,252	6,305
Net	21,816	15,986	7,514	8,664
Dec. 21 to Oct. 20—				
Gross	278,363	185,874	163,161	143,192
Returned	120,082	76,251	75,799	67,815
Net	158,281	109,623	87,362	75,377
Total outstanding Oct. 20	1,077,402	882,250	762,338	649,047

ADVERTISERS' HINTS

OHIO ELECTRIC SPECIALTY CO., Troy, O., will be pleased to supply descriptive circulars and prices on their rheostats, motor starters, speed regulators, etc. They are manufactured with a view to durability, compactness and reliability, as well as being fire proof, and at the same time ornamental.

THE CUTLER-HAMMER MFG. CO., 70 W. Jackson Boulevard, Chicago, Ill., state that there are more C.-H. rheostats in use than of all other makes combined.

WAGNER ELECTRIC MFG. CO., St. Louis, Mo., say their transformers are first in competitive tests, because they are the best and are designed on lines best adapted to practical central station operation.

C. W. HUNT CO., West New Brighton, S. I., N. Y., offer to send their catalogue No. 9810, treating of coal handling for steam generation.

SIPE & SIGLER, Cleveland, O., state the reason why they claim the Willard storage battery is superior to all others. They are ready to furnish cells of any size for test purposes at one-half their lowest net prices.

HUEBEL & MANGER, 286 Graham street, Brooklyn, N. Y., advertise their "F" style bells as the standard of excellence. They embody pure platinum contact points, pivoted armature, double adjustment and non-turning binding and contact posts.

THE VICTOR TELEPHONE MFG. CO., 166 So. Clinton street, Chicago, Ill., say there would be little complaint were all transmitters as good as the Victor, as there is a naturalness about the Victor instrument that cannot be over estimated. There are over 10,000 in use at the present time.

THE KELSEY NOISELESS RATCHET BRAKE is advertised by the Billings & Spencer Co., of Hartford, Conn. They say it is quick in operation, has great strength, a positive clutch, and, as its name implies, is noiseless.

WESTERN NOTES

MR. OTTO M. KNOBLOCH, secretary and treasurer of The Miller-Knobloch Company, South Bend, Ind., says that the commutator building and refilling and armature winding branch of their business has assumed very large proportions. This increase of business has necessitated additions to their factory equipment and a night shift of men. He reports orders from South Africa, Europe and Japan.

LIGHTNING. One of the greatest problems which presents

Digitized by Google

itself to every electric light station manager is the proper protection of electrical machinery from damage by lightning. Anything leading to a proper solution of the problem is always welcome. The Electric Appliance Company have just issued a special circular of Wurts lightning arresters, which embodies all of the improvements to date in this class of apparatus and gives some valuable hints with reference to protection from lightning.

SIEMENS & HALSKE ELEC. CO. are reported to have a $10,000,000 deal on hand for lighting and railway work, with the Japanese authorities.

CLEVELAND, O. The Abbott Electric & Mfg. Co. has been formed by H. H. Hammond, H. I. Wickes, W. A. Marbach, S. Abbott and C. B. Abbott, with a capital stock of $15,000, for the manufacture of electrical and mechanical appliances.

NUMEROUS SALES of apparatus are being reported from the West and Southwest, which denote a very healthy condition of the apparatus branch of electrical business. The Western Electrical Supply Co., of St. Louis, Mo., have recently made several large sales of apparatus in their territory, of both arc, direct current and alternating machinery.

NEW YORK NOTES.

MR. H. W. POPE, as traffic manager for the Southern Bell Telephone & Telegraph Co., has issued an excellent little brochure of data and information, showing how the telephone is used, should be used, and should not be used. It includes a number of fac-simile letters as to satisfaction given with party line service.

MR. H. T. EDGAR has come to town and will now have his headquarters at the Bowling Green Building, in connection with the Jandus interests, which his concern, H. W. Lawton & Co., represent in New England, with the Washington carbons, etc. He has also taken up the carbon agency for Northern New Jersey, Eastern New York and Greater New York. Just before leaving Boston he sold Pres. F. A. Gilbert a carload of high grade carbons for the enclosed arcs to be used in that city.

FOWLER SWITCHBOARD & TELEPHONE CO., has been formed in New York City with a capital stock of $5,000. There are three directors, one of whom is Mr. J. T. McRoy, the terra cotta conduit manufacturer. Another is L. V. Hecklers, of Brooklyn.

MR. SAMUEL MANKOWITZ, the well known wire manufacturer, reports a very large increase in the demand for his weather-proof and rubber-covered wire.

POMPTON, N. J. The Berlin Iron Bridge Company, East Berlin, Conn., are furnishing for the Laflin & Rand Powder Company the steel roof for one of their storehouses. The building is 45 feet wide and 150 feet long. The roof trusses are of steel and the roof trusses are corrugated iron supported on steel purlins.

PHILADELPHIA NOTES

PHILADELPHIA. The Cheltenham Electric Light, Heat and Power Company is in the market for arc light machinery and appliances for about 80 lights. Mr. G. U. G. Holman, manager, Oak Lane, Philadelphia, should be addressed.

ALLEGHENY, PA. In order to obtain as perfect a light as possible in the dry goods department of their store, Boggs & Buhl, of Allegheny, Pa., have just installed no fewer than 200 General Electric enclosed arc lamps of the double globe type. The whiteness of the light enables purchasers to select their goods with the assurance that the colors will not prove any different when brought to the light of day.

THE HELIOS ELECTRIC CO., of Philadelphia, through their Boston agents, the Anchor Electric Co., have received a large order from Jordan, Marsh & Co., of the latter city. The order was awarded after severe and protracted tests of a competitive character.

R. D. NUTTALL COMPANY, of Pittsburg, have made the Electric Tramway Company, of London, their representatives in the British Isles for their gears, trolleys, etc.

NEW ENGLAND NOTES

MITCHELL-PEARSON ELECTRIC CO. has been organized under the laws of Maine, with a capital stock of $150,000, of which $25 is paid in. It is to make and sell electric car appliances. The president is G. A. Copeland, Revere, Mass., and treasurer, W. E. Pearson, Winthrop, Mass.

SOUTHERN NOTES

MASON, TEXAS. The Mason Electric Light Co. are in the market for a full line of electrical supplies and apparatus, and wish to hear from parties who can furnish the goods. Mr. V. M. Loring is the secretary of the company; Mr. Chas. Faubion, electrician; Mr. R. Grosse, treasurer, and Mr. Leo Gugenheim, president.

NEW ORLEANS, LA. Mr. George F. Schimke, well known electrical constructor, late of the firm of Schimke & Newman, has opened business for his own acount at 420-422 Baronne St.

CONTENTS.

EDITORIALS:
Farewell to the Street Railway Cable 462
The Popularity of the Enclosed Arc 463
Telegraph Lines in Cuba 463
The Trolley and the Dublin Jarvey 463
TELEPHONY AND TELEGRAPHY:
The Development and Present Status of Submarine Telegraphy and Cables (illustr.).....Herbert Laws Webb. 453
The New French Atlantic Cable (illustr.) 457
The New Telephone Exchange, at Newport, R. I. (illustr.)..... 458
ELECTRIC TRANSPORTATION:
Rails, Their Construction from a Scientific Standpoint..... A. T. Moxham. 459
The Cost of City Traction.—Electric Traction by Water Power on Italian Railways 460
A Real Trolley Road for London.—A Trolley for Santiago de Cuba. 461
LITERATURE:
Herdman and Nagler's "A Laboratory Manual of Therapeutics"... 461
ROENTGEN RAYS:
Conditions of Luminosity in Vacuum Tubes 461
The Magnetic Deflection of Diffusely Reflected Cathode Rays.... Ernest Merritt. 461
MISCELLANEOUS:
Experiments with High Frequency Currents (illustr.).—Electricity at the British Association Meeting 464
The Electrical Resistance of Iron Wires.....Ernest Merritt. 464
ELECTRIC LIGHTING:
The Rushmore Three-Wire Dynamo (illustr.) 465
Fire Risk with the Vitascope, etc..... 466
EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, BOSTON:
New England Telephone and Telegraph Co.'s Exhibit (illustr.).... 466
Exhibit of Holtzer-Cabot Apparatus (illustr.).—The Ridgway Dynamo and Engine Co.'s Exhibit (illustr.) 467
Fine Telephone Exhibit of Whitman & Couch (illustr.).—Working Exhibit of the Burton Electric Smelting Co. (illustr.).—Interesting Exhibits at the Mechanics' Fair, Boston 468
POWER TRANSMISSION:
The Electrical Equipment of the Conkey Printing Establishment—I. (illustr.).....George A. Damon. 469
Bernard Enclosed "Barrel" Motors and Generators (illustr.)..... 470
PERSONAL:
J. H. Hallberg.—Mr. Joseph Leiter.—Mr. C. O. Baker 470
EDUCATIONAL:
New Mechanics' Arts' Hall, University of Nebraska (illustr.)..... 470
OBITUARY:
Charles H. Summers.—Henry Flint Dennis 471
INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Oct. 25, 1898.. 471
TRADE NOTES AND NOVELTIES:
The Hanchett Direct Reading Ohmmeter (illustr.).—High and Low Frequency Single Phase G. E. Alternators (illustr.)..... 472
Telephone Apparatus of the Eureka Electric Co.—Goodsell's "98" Pump Packing (illustr.) 473
Standard Paint Factory at Hamburg, Germany (illustr.).—Frink's Patent Reflectors (illustr.) 474
Independent Telephone Meeting.—Warner Pocket Battery Gauge (illustr.).—Bell Telephone Output.—Advertisers' Hints.—Western Notes 475
New York Notes.—Philadelphia Notes.—New England Notes.—Southern Notes 476

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. NOVEMBER 17, 1898. No. 550.

MISCELLANEOUS

High Frequency Oscillators for Electro-therapeutic and Other Purposes.[1]

BY NIKOLA TESLA.

SOME theoretical possibilities offered by currents of very high frequency and observations which I casually made while pursuing experiments with alternating currents, as well as the stimulating influence of the work of Hertz and of views boldly put forth by Oliver Lodge, determined me some time during 1889 to enter a systematic investigation of high frequency phenomena, and the results soon reached were such as to justify further efforts towards providing the laboratory with efficient means for carrying on the research in this particular field, which has proved itself so fruitful since. As a consequence alternators of special design were constructed and various arrangements for converting ordinary into high frequency currents perfected, both of which were duly described and are now —I assume—familiar.

One of the early observed and remarkable features of the high frequency currents, and one which was chiefly of interest to the physician, was their apparent harmlessness which made it possible to pass relatively great amounts of electrical energy through the body of a person without causing pain or serious discomfort. This peculiarity which, together with other mostly unlooked-for properties of these currents I had the honor to bring to the attention of scientific men first in an article in a technical journal in February, 1891, and in subsequent contributions to scientific societies, made it at once evident, that these currents would lend themselves particularly to electro-therapeutic uses.

With regard to the electrical actions in general, and by analogy, it was reasonable to infer that the physiological effects, however complex, might be resolved in three classes. First the statical, that is, such as are chiefly dependent on the magnitude of electrical potential; second, the dynamical, that is, those principally dependent on the quality of electrical movement or current's strength through the body, and third, effects of a distinct nature due to electrical waves or oscillations, that is, impulses in which the electrical energy is alternately passing in more or less rapid succession through the static and dynamic forms.

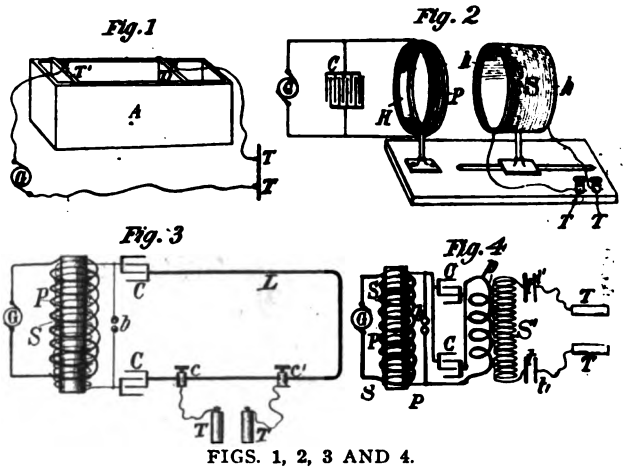
Most generally in practice these different actions are coexistent, but by a suitable selection of apparatus and observance of conditions the experimenter may make one or other of these effects predominate. Thus he may pass through the body, or any part of the same, currents of comparatively large volume under a small electrical pressure, or he may subject the body to a high electrical pressure while the current is negligibly small, or he may put the patient under the influence of electrical waves transmitted, if desired, at considerable distance through space.

While it remained for the physician to investigate the specific actions on the organism and indicate proper methods of treatment, the various ways of applying these currents to the body of a patient suggested themselves readily to the electrician.

As one cannot be too clear in describing a subject, a diagrammatic illustration of the several modes of connecting the circuits which I will enumerate, though obvious for the majority, is deemed of advantage.

The first and simplest method of applying the currents was to connect the body of the patient to two points of the generator, be it a dynamo or induction coil. Fig. 1 is intended to illustrate this case. The alternator G may be one giving from five to ten thousand complete vibrations per second, this number being still within the limit of practicability. The electromotive force—as measured by a hot wire instrument—may be from fifty to one hundred volts. To enable strong currents to be passed through the tissues, the terminals T T, which serve to establish contact with the patient's body should, of course, be of large area, and covered with cloth saturated with a solution of electrolyte harmless to the skin, or else the contacts are made by immersion. The regulation of the currents is best effected by means of an insulating trough A provided with two metal terminals T′ T′ of considerable surface, one of which, at least, should be movable. The trough is filled with water, and an electrolytic solution is added to the same, until a degree of conductivity is obtained suitable for the experiments.

When it is desired to use small currents of high tension, a secondary coil is resorted to, as illustrated in Fig. 2. I have found it from the outset convenient to make a departure from the ordinary ways of winding the coils with a considerable number of small turns. For many reasons the physician will find it better to provide a large hoop H of not less than, say, three feet in diameter and preferably more, and to wind upon it a few turns of stout cable P. The secondary coil S is easily prepared by taking two wooden hoops h h and joining them with stiff cardboard. One single layer of ordinary magnet wire, and not too thin at that, will be generally sufficient, the number of turns necessary for the particular use for which the coil is intended being easily ascertained by a few trials. Two plates of large surface, forming an adjustable condenser, may be used for the purpose of synchronizing the secondary with the primary circuit, but this is generally not necessary. In this manner a



FIGS. 1, 2, 3 AND 4.

cheap coil is obtained, and one which cannot be easily injured. Additional advantages, however, will be found in the perfect regulation which is effected merely by altering the distance between the primary and secondary, for which adjustment provision should be made, and, furthermore, in the occurrence of harmonics which are more pronounced in such large coils of thick wire, situated at some distance from the primary.

The preceding arrangements may also be used with alternating or interrupted currents of low frequency, but certain peculiar properties of high frequency currents make it possible to apply the latter in ways entirely impracticable with the former.

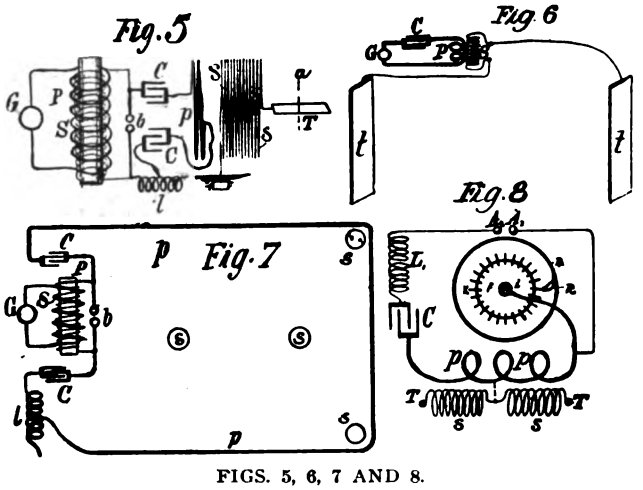
One of the prominent characteristics of high frequency or, to be more general, of rapidly varying currents, is that they pass with difficulty through stout conductors of high self-induction. So great is the obstruction which self-induction offers to their passage that it was found practicable, as shown in the early experiments to which reference has been made, to maintain differences of potential of many thousands of volts between two points—not more than a few inches apart—of a thick copper bar of inappreciable resistance. This observation naturally suggested the disposition illustrated in Fig. 3. The source of high frequency impulses is in this instance a familiar type of transformer which may be supplied from a generator G of ordinary direct or alternating currents. The transformer comprises a primary P, a secondary S, two condensers C C which are joined in series, a loop or coil of very thick wire L and a circuit interrupting device or break b. The currents are derived

[1]Read at the eighth annual meeting of The American Electro-Therapeutic Association, Buffalo, N. Y., Sept. 13 to 15, 1898.

Digitized by Google

from the loop L by two contacts c c', one or both of which are capable of displacement along the wire L. By varying the distance between these contacts, any difference of potential, from a few volts to many thousands, is readily obtained on the terminals or handles T T. This mode of using the currents is entirely safe and particularly convenient, but it requires a very uniform working of the break b employed for charging and discharging the condenser.

Another equally remarkable feature of high frequency impulses was found in the facility with which they are transmitted through condensers, moderate electromotive forces and very small capacities being required to enable currents of considerable volume to pass. This observation made it practicable to resort to a plan such as indicated in Fig. 4. Here the connections are similar to those shown in the preceding case, except that the condensers C C are joined in parallel. This lowers the frequency of the currents, but has the advantage of allowing the working with a much smaller difference of potential on the terminals of the secondary S. Since the latter is the chief item of expense of such apparatus and since its price rapidly increases with the number of turns required, the experimenter will find it generally cheaper to make a sacrifice in the frequency, which, however, will be high enough for most purposes. However, he only needs to reduce proportionately the number of turns or the length of primary p to obtain the same frequency as before, but the economy of transformation will be somewhat



FIGS. 5, 6, 7 AND 8.

reduced in so doing and the break b will require more attention. The secondary S^1 of the high frequency coil has two metal plates t t of considerable surface connected to its terminals, and the current for use is derived from two similar plates t' t' in proximity to the former. Both the tension and volume of the currents taken from terminals T T may be easily regulated and in a continuous manner by simply varying the distance between the two pair of plates t t and t' t' respectively.

A facility is also afforded in this disposition for raising or lowering the potential of one of the terminals T, irrespective of the changes produced on the other terminal, this making it possible to cause a stronger action on one or other part of the patient's body.

The physician may find it for some or other reason convenient to modify the arrangements in Figs. 2, 3 and 4 by connecting one terminal of the high frequency source to the ground. The effects will be in most respects the same, but certain peculiarities will be noted in each case. When a ground connection is made it may be of some consequence which of the terminals of the secondary is connected to the ground, as in high frequency discharges the impulses of one direction are generally preponderating.

Among the various noteworthy features of these currents there is one which lends itself especially to many valuable uses. It is the facility which they afford for conveying large amounts of electrical energy to a body entirely insulated in space. The practicability of this method of energy transmission, which is already receiving useful applications and promises to become of great importance in the near future, has helped to dispel the old notion assuming the necessity of a return circuit for the conveyance of electrical energy in any considerable amount. With novel appliances we are enabled to pass through a wire, entirely insulated on one end, currents strong enough to fuse it, or to convey through the wire any amount of energy to an insulated body. This mode of applying high frequency currents in medical treatment appears to me to offer the greatest possibilities at the hands of the physician. The effects produced in this manner possess features entirely distinct from those observed when the currents are applied in any of the before mentioned or similar ways.

The circuit connections as usually made are illustrated schematically in Fig. 5, which, with reference to the diagrams before shown, is self-explanatory. The condensers C C, connected in series, are preferably charged by a step-up transformer, but a high frequency alternator, static machine, or a direct current generator, if it be of sufficiently high tension to enable the use of small condensers, may be used with more or less success. The primary p, through which the high frequency discharges of the condensers are passed, consists of very few turns of cable of as low resistance as possible, and the secondary s, preferably at some distance from the primary to facilitate free oscillation, has one of its ends—that is the one which is nearer to the primary—connected to the ground, while the other end leads to an insulated terminal T, with which the body of the patient is connected. It is of importance in this case to establish synchronism between the oscillations in the primary and secondary circuits p and s respectively. This will be as a rule best effected by varying the self-induction of the circuit including the primary loop or coil p, for which purpose an adjustable self-induction e is provided; but in cases when the electromotive force of the generator is exceptionally high, as when a static machine is used and a condenser consisting of merely two plates offers sufficient capacity, it will be simpler to attain the same object by varying the distance of the plates.

The primary and secondary oscillations being in close synchronism, the points of highest potential will be on a part of terminal T, and the consumption of energy will occur chiefly there. The attachment of the patient's body to the terminal will in most cases very materially affect the period of oscillation in the secondary, making it longer, and a readjustment of the primary circuit will have to be made in each case to suit the capacity of the body connected with terminal T. Synchronism should always be preserved, and the intensity of the action varied by moving the secondary coil to or from the primary, as may be desired. I know of no method which would make it possible to subject the human body to such excessive electrical pressures as are practicable with this, or of one which would enable the conveying to and giving off from the body without serious injury amounts of electrical energy approximating even in a remote degree those which are entirely practicable when this manner of applying the energy is resorted to. This is evidently due to the fact that the action is chiefly superficial, the largest possible section being offered to the transfer of the current, or, to say more correctly, of the energy. With a very rapidly and smoothly working break I would not think it impossible to convey to the body of a person and to give off into the space energy at the rate of several horse power with impunity, while a small part of this amount applied in other ways could not fail to produce injury.

When a person is subjected to the action of such a coil, the proper adjustments being carefully observed, luminous streams are seen in the dark issuing from all parts of the body. These streams are short and of delicate texture when the number of breaks is very great and the action of the device b (Fig. 5) free of any irregularities, but when the number of breaks is small or the action of the device imperfect, long and noisy streams appear which cause some discomfort. The physiological effects produced with apparatus of this kind may be graduated from a hardly perceptible action when the secondary is at a great distance from the primary, to a most violent one when both coils are placed at a small distance. In the latter case only a few seconds are sufficient to cause a feeling of warmth all over the body, and soon after the person perspires freely. I have repeatedly, in demonstrations to friends, exposed myself longer to the action of the oscillations, and each time, after the lapse of an hour or so, an immense fatigue, of which it is difficult to give an idea, would take hold of me. It was greater than I experienced on some occasions after the most straining and prolonged bodily exertion. I could scarcely make a step and could keep the eyes open only with the greatest difficulty. I slept soundly afterward, and the after-effect was

Digitized by Google

certainly beneficial, but the medicine was manifestly too strong to be used frequently.

One should be cautious in performing such experiments for more than one reason. At or near the surface of the skin, where the most intense action takes place, various chemical products are formed, the chief being ozone and nitrogen compounds. The former is itself very destructive, this feature being illustrated by the fact that the rubber inslation of a wire is destroyed so quickly as to make the use of such insulation entirely impracticable. The compounds of nitrogen, when moisture is present, consists largely of nitric acid which might, by excessive application, prove hurtful to the skin. So far, I have not noted injuries which could be traced directly to this cause, though on several occasions burns were produced in all respects similar to those which were later observed and attributed to the Röntgen rays. This view is seemingly being abandoned, having not been substantiated by experimental facts, and so also is the notion that these rays are transverse vibrations. But while investigation is being turned in what appears to be the right direction, scientific men are still at sea. This state of things impedes the progress of the physicist in these new regions and makes the already hard task of the physician still more difficult and uncertain.

One or two observations made while pursuing experiments with the apparatus described might be found as deserving mention here. As before stated, when the oscillations in the primary and secondary cirucits are in synchronism, the points of highest potential are on some portion of the terminal T. The synchronism being perfect and the length of the secondary coil just equal to one-quarter of the wave length, these points will be exactly on the free end of terminal T, that is, the one situated farthest from the end of the wire attached to the terminal. If this be so and if now the period of the oscillations in the primary be shortened, the points of highest potential will recede towards the secondary coil, since the wave-length is reduced and since the attachment of one end of the secondary coil to the ground determines the position of the nodal points, that is, the points of least potential. Thus, by varying the period of vibration of the primary circuit in any manner, the points of highest potential may be shifted accordingly along the terminal T, which has been shown, designedly, long to illustrate this feature. The same phenomenon is, of course, produced if the body of a patient constitutes the terminal, and an assistant may by the motion of a handle cause the points of highest potential to shift along the body with any speed he may desire. When the action of the coil is vigorous, the region of highest potential is easily and unpleasantly located by the discomfort or pain experienced, and it is most curious to feel how the pain wanders up and down, or eventually across the body, from hand to hand, if the connection to the coil is accordingly made—in obedience to the movement of the handle controlling the oscillations. Though I have not observed any specific action in experiments of this kind, I have always felt that this effect might be capable of valuable use in electro-therapy.

Another observation which promises to lead to much more useful results is the following: As before remarked, by adopting the method described, the body of a person may be supjected without danger to electrical pressures vastly in excess of any producible by ordinary apparatus, for they may amount to several million volts, as has been shown in actual practice. Now, when a conducting body is electrified to so high a degree, small particles, which may be adhering firmly to its surface, are torn off with violence and thrown to distances which can be only conjectured. I find that not only firmly adhering matter, as paint, for instance, is thrown off, but even the particles of the toughest metals are torn off. Such actions have been thought to be restricted to a vacuous inclosure, but with a powerful coil they occur also in the ordinary atmosphere. The facts mentioned would make it reasonable to expect that this extraordinary effect which, in other ways, I have already usefully applied, will likewise prove to be of value in electro-therapy. The continuous improvement of the instruments and the study of the phenomenon may shortly lead to the establishment of a novel mode of hygienic treatment which would permit an instantaneous cleaning of the skin of a person, simply by connecting the same to, or possibly, by merely placing the person in the vicinity of a source of intense electrical oscillations, this having the effect of throwing off, in a twinkle of the eye, dust or particles of any extraneous matter adhering to the body. Such a result brought about in a practicable manner would, without doubt, be of incalculable value in hygiene and would be an efficient and time-saving substitute for a water bath, and particularly appreciated by those whose contentment consists in undertaking more than they can accomplish.

High frequency impulses produce powerful inductive actions and in virtue of this feature they lend themselves in other ways to the uses of the electro-therapeutist. These inductive effects are either electrostatic or electrodynamic. The former diminish much more rapidly with the distance—with the square of the same—the latter are reduced simply in proportion to the distance. On the other hand, the former grow with the square of intensity of the source, while the latter increase in a simple proportion with the intensity. Both of these effects may be utilized for establishing a field of strong action extending through considerable space, as through a large hall, and such an arrangement might be suitable for use in hospitals or institutions of this kind, where it is desirable to treat a number of patients at the same time.

Fig. 6 illustrates the manner, as I have shown it originally, in which such a field of electrostatic action is established. In this diagram G is a generator of currents of very high frequency, C a condenser for counteracting the self-induction of the circuit which includes the primary P of an induction coil, the secondary S of which has two plates t t of large surface connected

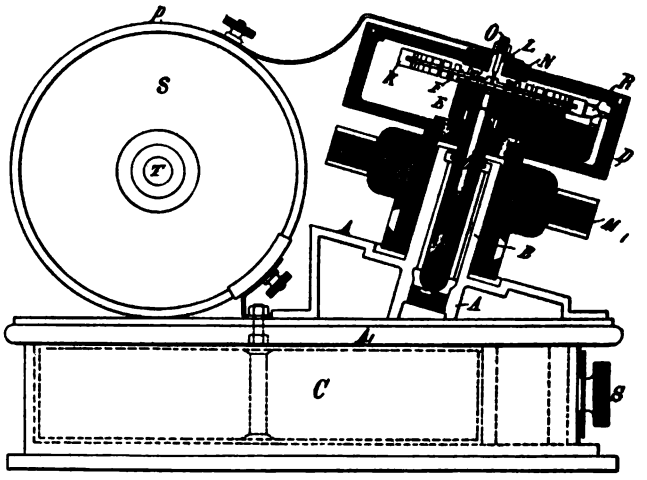


FIG. 9.

to its terminals. Well known adjustments being observed, a very strong action occurs chiefly in the space between the plates, and the body of a person is subjected to rapid variations of potential and surgings of current, which produce, even at a great distance, marked physiological effects. In my first experiments I used two metal plates as shown, but later I found it preferable to replace them by two large hollow spheres of brass covered with wax of a thickness of about two inches. The cables leading to the terminals of the secondary coil were similarly covered, so that any of them could be approached without danger of the insulation breaking down. In this manner the unpleasant shocks, to which the experimenter was exposed when using the plates, were prevented.

In Fig. 7 a plan for similarly utilizing the dynamic inductive effects of high frequency currents is illustrated. As the frequencies obtainable from an alternator are not as high as is desired, conversion by means of condensers is resorted to. The diagram will be understood at a glance from the foregoing description. It only need be stated that the primary p, through which the condensers are made to discharge, is formed by a thick stranded cable of low self-induction and resistance, and passes all around the hall. Any number of secondary coils s s s, each consisting generally of a single layer of rather thick wire, may be provided. I have found it practicable to use as many as one hundred, each being adjusted for a definite period and responding to a particular vibration passed through the primary. Such a plant I have had in use in my laboratory since 1892, and many times it has contributed to the pleasure of my visitors and also proved itself of practical utility. On a latter occasion I had the pleasure of entertaining some of the mem-

Digitized by Google

bers with experiments of this kind, and this opportunity I cannot let pass without expressing my thanks for the interest which was awakened in me by their visit, as well as for the generous acknowledgment of the courtesy by the Association. Since that time my apparatus has been very materially improved, and now I am able to create a field of such intense induction in the laboratory that a coil three feet in diameter, by careful adjustment, will deliver energy at the rate of one-quarter of a horse power, no matter where it is placed within the area inclosed by the primary loops. Long sparks, streamers and all other phenomena obtainable with induction coils are easily producible anywhere within the space, and such coils, though not connected to anything, may be utilized exactly as ordinary coils, and what is still more remarkable, they are more effective. For the past few years I have often been urged to show experiments in public, but, though I was desirous to comply with such requests, pressing work has so far made it impossible. These advances have been the result of slow but steady improvement in the details of the apparatus which I hope to be able to describe connectedly in the near future.

However remarkable the electrodynamic inductive effects, which I have mentioned, may appear, they may be still considerably intensified by concentrating the action upon a very small space. It is evident that since, as before stated, electromotive forces of many thousand volts are maintained between two points of a conducting bar or loop only a few inches long, electromotive forces of approximately the same magnitude will be set up in conductors situated near by. Indeed, I found that it was practicable in this manner to pass a discharge through a highly exhausted bulb, although the electromotive force required amounted to as much as ten or twenty thousand volts, and for a long time I followed up experiments in this direction with the object of producing light in a novel and more economical way. But the tests left no doubt that there was great energy consumption attendant to this mode of illumination, at least with the apparatus I had then at command, and, finding another method which promised a higher economy of transformation, my efforts turned in this new direction. Shortly afterward (some time in June, 1891,) Prof. J. J. Thomson described experiments which were evidently the outcome of long investigation, and in which he supplied much novel and interesting information, and this made me return with renewed zeal to my own experiments. Soon my efforts were centered upon producing in a small space the most intense inductive action, and by gradual improvement in the apparatus I obtained results of a surprising character. For instance, when the end of a heavy bar of iron was thrust within a loop powerfully energized, a few moments were sufficient to raise the bar to a high temperature. Even heavy lumps of other metals were heated as rapidly as though they were placed in a furnace. When a continuous band formed of a sheet of tin was thrust into the loop, the metal was fused instantly, the action being comparable to an explosion, and no wonder, for the frictional losses accumulated in it at the rate of possibly ten horse power. Masses of poorly conducting material behaved similarly, and when a highly exhausted bulb was pushed into the loop, the glass was heated in a few seconds nearly to the point of melting.

When I first observed these astonishing actions, I was interested to study their effects upon living tissues. As may be assumed, I proceeded with all the necessary caution, and well I might, for I had the evidence that in a turn of only a few inches in diameter an electromotive force of more than ten thousand volts was produced, and such high pressure would be more than sufficient to generate destructive currents in the tissue. This appeared all the more certain as bodies of comparatively poor conductivity were rapidly heated and even partially destroyed. One may imagine my astonishment when I found that I could thrust my hand or any other part of the body within the loop and hold it there with impunity. More than on one occasion, impelled by a desire to make some novel and useful observation, I have willingly or unconsciously performed an experiment connected with some risk, this being scarcely avoidable in laboratory experience, but I have always believed, and do so now, that I have never undertaken anything in which, according to my own estimation, the chances of being injured were so great as when I placed my head within the space in which such terribly destructive forces were at work. Yet I have done so, and repeatedly, and have felt nothing. But I am firmly convinced that there is great danger attending such an experiment, and some one going just a step farther than I have gone may be instantly destroyed. For, conditions may exist similar to those observable with a vacuum bulb. It may be placed in the field of the loop, however intensely energized, and so long as no path for the current is formed, it will remain cool and consume practically no energy. But the moment the first feeble current passes, most of the energy of the oscillations rushes to the place of consumption. If by any action whatever, a conducting path were formed within the living tissue or bones of the head, it would result in the instant destruction of these and death of the foolhardy experimenter. Such a method of killing, if it were rendered practicable, would be absolutely painless. Now, why is it that in a space in which such violent turmoil is going on living tissue remains uninjured? One might say the currents cannot pass because of the great self-induction offered by the large conducting mass. But this it cannot be, because a mass of metal offers a still higher self-induction and is heated just the same. One might argue the tissues offer too great a resistance. But this again cannot be the reason, for all evidence shows that the tissues conduct well enough, and besides, bodies of approximately the same resistance are raised to a high temperature. One might attribute the apparent harmlessness of the oscillations to the high specific heat of the tissue, but even a rough quantitative estimate from experiments with other bodies shows that this view is untenable. The only plausible explanation I have so far found is that the tissues are condensers. This only can account for the absence of injurious action. But it is remarkable that, as soon as a heterogeneous circuit is constituted, as by taking in the hands a bar of metal and forming a closed loop in this manner, the passage of the currents through the arms is felt, and other physiological effects are distinctly noted. The strongest action is, of course, secured when the exciting loop makes only one turn, unless the connections take up a considerable portion of the total length of the circuit, in which case the experimenter should settle upon the least number of turns by carefully estimating what he loses by increasing the number of turns, and what he gains by utilizing thus a greater proportion of the total length of the circuit. It should be borne in mind that, when the exciting coil has a considerable number of turns and is of some length, the effects of electrostatic induction may preponderate, as there may exist a very great difference of potential—a hundred thousand volts or more—between the first and last turn. However, these latter effects are always present even when a single turn is employed.

When a person is placed within such a loop, any pieces of metal, though of small bulk, are perceptibly warmed. Without doubt they would be also heated—particularly if they were of iron—when embedded in living tissue, and this suggests the possibility of surgical treatment by this method. It might be possible to sterilize wounds, or to locate, or even to extract metallic objects, or to perform other operations of this kind within the sphere of the surgeon's duties in this novel manner.

Most of the results enumerated, and many others still more remarkable, are made possible only by utilizing the discharges of a condenser. It is probable that but a very few—even among those who are working in these identical fields—fully appreciate what a wonderful instrument such a condenser is in reality. Let me convey an idea to this effect. One may take a condenser, small enough to go in one's vest pocket, and by skilfully using it he may create an electrical pressure vastly in excess—a hundred times greater if necessary—than any producible by the largest static machine ever constructed. Or, he may take the same condenser and, using it in a different way, he may obtain from it currents against which those of the most powerful welding machine are utterly insignificant. Those who are imbued with popular notions as to the pressures of static machines and currents obtainable with a commercial transformer, will be astonished at this statement—yet the truth of it is easy to see. Such results are obtainable, and easily, because the condenser can discharge the stored energy in an inconceivably short time. Nothing like this property is known in physical science. A compressed spring, or a storage battery, or any other form of device capable of storing energy, cannot do this; if they could, things undreamt of at present might be accomplished by their means. The nearest approach to a charged condenser is a high explosive, as dynamite. But even the most violent explosion of such a compound bears no comparison with the discharge or explosion of a condenser. For, while the pressures which are produced in the detonation of a chem-

Digitized by Google

ical compound are measured in tens of tons per square inch, those which may be caused by condenser discharges may amount to thousands of tons per square inch, and if a chemical could be made which would explode as quickly as a condenser can be discharged under conditions which are realizable—an ounce of it would quite certainly be sufficient to render useless the largest battleship.

That important realizations would follow from the use of an instrument possessing such ideal properties I have been convinced since long ago, but I also recognized early that great difficulties would have to be overcome before it could replace less perfect implements now used in the arts for the manifold transformations of electrical energy. These difficulties were many. The condensers themselves, as usually manufactured, were inefficient, the conductors wasteful, the best insulation inadequate, and the conditions for the most efficient conversion were hard to adjust and to maintain. One difficulty, however, which was more serious than the others, and to which I called attention when I first described this system of energy transformation, was found in the devices necessarily used for controlling the charges and discharges of the condenser. They were wanting in efficiency and reliability and threatened to prove a decided drawback, greatly restricting the use of the system and depriving it of many valuable features. For a number of years I have tried to master this difficulty. During this time a great number of such devices were experimented upon. Many of them promised well at first, only to prove inadequate in the end. Reluctantly, I came back upon an idea on which I had worked long before. It was to replace the ordinary brushes and commutator segments by fluid contacts. I had encountered difficulties then, but the intervening years in the laboratory were not spent in vain, and I made headway. First it was necessary to provide for a circulation of the fluid, but forcing it through by a pump proved itself impractical. Then the happy idea presented itself to make the pumping device an integral part of the circuit interrupter, inclosing both in a receptacle to prevent oxydation. Next some simple ways of maintaining the circulation, as by rotating a body of mercury, presented themselves. Then I learned how to reduce the wear and losses which still existed. I fear that these statements, indicating how much effort was spent in these seemingly insignificant details will not convey a high idea of my ability, but I confess that my patience was taxed to the utmost. Finally, though, I had the satisfaction of producing devices which are simple and reliable in their operation, which require practically no attention and which are capable of effecting a transformation of considerable amounts of energy with fair economy. It is not the best that can be done, by any means, but it is satisfactory, and I feel that the hardest task is done.

The physician will now be able to obtain an instrument suitable to fulfil many requirements. He will be able to use it in electro-therapeutic treatment in most of the ways enumerated. He will have the facility of providing himself with coils such as he may desire to have for any particular purpose, which will give him any current or any pressure he may wish to obtain. Such coils will consist of but a few turns of wire, and the expense of preparing them will be quite insignificant. The instrument will also enable him to generate Röntgen rays of much greater power than obtainable with ordinary apparatus. A tube must still be furnished by the manufacturers which will not deteriorate and which will allow to concentrate larger amounts of energy upon the electrodes. When this is done, nothing will stand in the way of an extensive and efficient application of this beautiful discovery which must ultimately prove itself of the highest value, not only at the hands of the surgeon, but also of the electro-therapist and, what is most important, of the bacteriologist.

To give a general idea of an instrument in which many of the latter improvements are embodied, I would refer to Fig. 9, which illustrates the chief parts of the same in side elevation and partially in vertical cross-section. The arrangement of the parts is the same as in the form of instrument exhibited on former occasions, only the exciting coil with the vibrating interrupter is replaced by one of the improved circuit breakers to which reference has been made.

This device comprises a casting A with a protruding sleeve B, which in a bushing supports a freely rotatable shaft a. The latter carries an armature within a stationary field magnet M and on the top, a hollow iron pulley D, which contains the break proper. Within the shaft a, and concentrically with the same, is placed a smaller shaft b, likewise freely movable on ball-bearings and supporting a weight E. This weight being on one side and the shafts a and b inclined to the vertical, the weight remains stationary as the pulley is rotated. Fastened to the weight E is a device R in the form of a scoop with very thin walls, narrow on the end nearer to the pulley and wider on the other end. A small quantity of mercury being placed in the pulley and the latter rotated against the narrow end of the scoop, a portion of the fluid is taken up and thrown in a thin and wide stream towards the centre of the pulley. The top of the latter is hermetically closed by an iron washer, as shown, this washer supporting on a steel rod L a disk F of the same metal provided with a number of thin contact blades K. The rod L is insulated by washers N from the pulley, and for the convenience of filling in the mercury a small screw o is provided. The bolt L forming one terminal of the circuit breaker is connected by a copper strip to the primary p. The other end of the primary coil leads to one of the terminals of the condenser C, contained in a compartment of a box A, another compartment of the same being reserved for switch S and terminals of the instrument. The other terminal of the condenser is connected to the casting A and through it to pulley D. When the pulley is rotated, the contact blades K are brought rapidly in and out of contact with the stream of mercury, thus closing and opening the circuit in quick succession. With such a device it is easy to obtain ten thousand makes and breaks per second and even more. The secondary s is made of two separate coils and so arranged that it can be slipped out, and a metal strip in its middle connects it to the primary coil. This is done to prevent the secondary from breaking down when one of the terminals is overloaded, as it often happens in working Röntgen bulbs. This form of coil will withstand a very much greater difference of potential than coils as ordinarily constructed.

The motor has both field and armature built of plates, so that it can be used on alternating as well as direct current supply circuits, and the shafts are as nearly as possible vertical, so as to require the least care in oiling. Thus, the only thing which really requires some attention is the commutator of the motor, but where alternating currents are always available, this source of possible trouble is easily done away with.

The circuit connections of the instrument have been already shown and the mode of operation explained in periodicals. The usual manner of connecting is illustrated in Fig. 8, in which A_2 A_2 are the terminals of the supply circuit, L, a self-induction coil for raising the pressure, which is connected in series with condenser C and primary P P. The remaining letters designate the parts correspondingly marked in Fig. 9 and will be understood with reference to the latter.

Mr. Rosenbaum Before the Franklin Institute on Electrical Invention.

A PAPER was read on November 8 before the Electrical Section of the Franklin Institute, on "The Status of Electrical Invention," by Mr. William A. Rosenbaum, electrical expert and patent solicitor of New York. The speaker treated the question somewhat from the standpoint of the patent lawyer in that he adopted the technical meaning of the word "invention" instead of its popular meaning. Each of the main branches of the science of electricity was taken up in turn and the inventions therein referred to and described which have been responsible for, or have directed the lines of, its development. Thus in the building up of a branch of the art, certain inventions appear from time to time, from which spring new lines of development or improvement, and these, which the speaker termed the "milestones in the progress of invention," were briefly described and their proper places in the art located.

In telegraphy, the "milestones" noted were, the needle telegraph, the Morse key, relay, sounder, and register; the repeater, the duplex, quadruplex, the dynamo quadruplex key system, the multiplex, the writing and printing telegraph, telegraphing from moving trains, the submarine telegraph, the synchronograph and the wireless telegraph.

In telephony, the steps mentioned were the receiver, the microphone transmitter, the induction coil, the magneto call, the automatic switch, the various switchboards and the repeater, the last noted as a device to which considerable attention has been given by inventors, without achieving success.

Digitized by Google

The list of leading inventions under arc lighting included (after brief mention of the work of early investigators), the "shunt" circuit and the "differential" lamp, the clutch, the double carbon lamp, the "enclosed arc" lamp and the focusing lamp. In incandescent lighting the speaker asserted that the art was substantially perfected with the discovery of the first commercial lamp and the "three-wire" system of distribution, both the work of Mr. Edison. Other electric lighting inventions noted were the vacuum tube system and the X-rays.

In the development of the dynamo, Faraday's machine came first; then followed a machine giving alternating currents, then the commutator, the self-exciting machine, the laminated armature, the machine without moving wire, the shuttle armature, the shunt wound machine, the Pacinotti ring, the Gramme ring and compound winding. Under the head of electric motors, the polyphase motor was especially mentioned.

Under chemical generation and storage of electrical energy, the various types of primary and secondary batteries were described.

The electric railway was stated to have made its first appearance in 1837, in the shape of a model built by the Vermont blacksmith Davenport. The leading inventions were, the connecting of the motor on the vehicle with a stationary dynamo, the overhead wire and trolley, the sub-trolley and plough, the controller, the carbon brush for the motor, the hinged and spring-mounted motor and the slow speed motor.

The paper closed with the prophecy that, "wireless" telegraphy now being a fact, we shall ere long be able to telephone without wires, have electric lights without wires, ride in electric cars propelled by electricity delivered thereto from a stationary dynamo without connecting wires, and transmit electric power, in general, without wires. As to the last, the fact was noted that Tesla has very recently suggested the transmission of large quantities of current through the rarefied regions of the atmosphere.

The Loss of the "Mohegan."

Attention has been called to the fact that when the steamer "Mohegan" ran on the Manacles Rocks, her electrical plant was submerged, all her lights went out immediately, and as the ship was plunged in utter darkness the loss of life was the greater. A protest has been sent to the English Government by chambers of commerce and port authorities, calling attention to the facts in the case of the "Mohegan," and requesting that stringent orders be issued requiring that all the regulation lights be of oil, as before, leaving the other lights of the vessel to be determined by the owners.

This is a matter which concerns vessel owners and vesselmen —and passengers—on the lakes, and it has been taken up by some of the lake newspapers at Cleveland, etc. In some of the newer steel craft electric lights are used altogether when out of harbor, the oil lamps being used only when in port and the engines are not in action. What might happen in a crowded channel should there be a sudden derangement of the electrical machinery is suggested by the additions to the "Mohegan" death roll through the extinction of the electric lights at the moment when light was most needed.

Ventilation of Hoosac Railway Tunnel.

Electricity has rarely subserved a more useful purpose than that to which it is to be applied by the Fitchburg Railroad Company on Hoosac mountain, says the Hartford "Times." It is proposed to install a huge blower in a hood at the top of the long-disused central shaft of the tunnel, which is over 1,000 feet in depth. This will be operated by an electric motor, the current coming from the North Adams Electric Company, and the result will be to extract the smoke from the tunnel. The shaft is about midway of the tunnel, and the grade descends from that point both east and west. There has never been enough of a draft of air through the tunnel to clear it of smoke. But the great 125 h. p. electric blower at the top of the mountain will do the work.

DENVER, COL. Mr. D. H. Moffat is endeavoring to consolidate the six different street railway systems, of which three are now electric, and then, it is said, to electrify the united system.

The Electrical Equipment of the Conkey Printing Establishment.[1]—II.

BY GEORGE A. DAMON.

THE whole line of machinery is connected on the "Arnold System" of power station construction. In this system each generator armature is mounted in such a way as to be perfectly independent of the remaining machinery, and by means of a suitable coupling can be put in operation or thrown out of service, at will. The shaft upon which each generator armature is mounted is made hollow so as to allow a solid shaft to be carried through it. This solid shaft is supported in two independent bearings near its middle and extends from engine to engine, but under normal operating conditions it is independent of the engines and of the generator shafts, and lies idle in its bearings. Each end of this shaft is provided with a suitable coupling so that it can be operated by either engine, or by both working in unison. The result of this ingenious arrangement of shaft, hollow quills, bearings and couplings, is that each generator can be operated by more than one engine. In a plant arranged with direct connected units this feature is a decided additional advantage, for the units can be operated in much the same manner as in a belted plant. Ordinarily in a

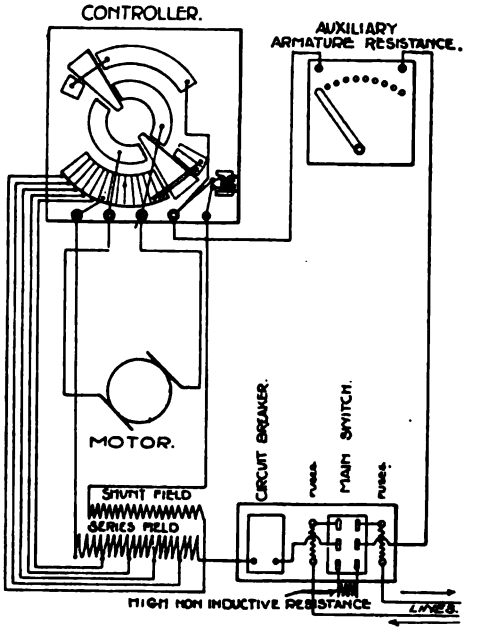


FIG. 3.—DIAGRAM OF CONTROLLER CONNECTIONS.

direct connected plant the crippling of a generator will shut down its driving engine, or if an engine breaks down its contiguous generator must necessarily be taken out of service. The Arnold system obviates this disadvantage and the result is that reliability is secured in the operation of the plant with less reserve machinery than is ordinarily required. The arrangement may look complicated, but in reality it is simple and for the advantages it secures it is comparatively inexpensive.

The method which has been adopted to provide for an increasing demand for power in this plant may prove of interest. At the present time engine No. 1 and generator No. 1 have been installed and are now handling the load. A smaller 50 k. w. high speed unit is being placed in position as shown in Fig. 2 for the purpose of carrying the load when the press room is working all night. It may also be used to furnish current for the lighting circuits when the combined power and lighting load become too large for the Corliss engine and 100 k. w. unit.

[1]Abstract of paper read before the Chicago Electrical Association.

Digitized by Google

Eventually as the load is increased in size, engine No. 2 and the two additional generators will be installed and the plant will then be ready to furnish economically all demands for power over a range of from 75 h p to 525 h p. It will be capable of handling a load of 400 h p with a reserve unit for operation in case of accident.

The Western Electric switchboard is of highly polished black enamelled slate, 1½ inches in thickness, with the usual indicating and regulating instruments. Separate omnibus bars are provided for the power circuits and the lighting circuits. Each generator is furnished with two main switches by means of which it may be operated on either the lights or the power circuits or upon both at the same time.

Each feeder leaving the board passes through a fuse, the fuses being fastened in a row upon a special fuse block at the top and back of the board. From this block the feeders pass directly through the wall of the engine room into the factory. The power and lighting distributing systems throughout the plant are independent of one another. In the factory two main distributing centres are located in a central position, one on the north wall of the bindery and the other on the north wall of the press room. These centres consist of small switchboards fastened to the side of the wall and surrounded with a hardwood asbestos lined cabinet. Their main bus-bars are connected back to the switchboard by means of large feeder cables. At each centre a separate cabinet is provided for the lights and power—the various circuits leading to the different parts of the building, leaving the distributing board through suitable switches and fuses. The main feeders are carried along the wall of the electrotype foundry to the press room. Thence they are carried on the under side of the iron roof truss by being supported on porcelain insulators fastened to iron beams, which are firmly bolted up against the angle iron of the roof. The distributing circuits are carried upon porcelain insulators attached directly to the under side of the wooden roof beams and above the iron trusses. All the feeders and mains are thus installed in the "open work" style of construction. A workmanlike job has been done, and the wiring presents a very neat appearance.

The leads to the various motors and the wires to the arc lamps and switches are carried in iron armored insulated conduit. In the case of a press motor, for instance, a porcelain cut-out in a suitable box, is placed at the top of an iron column, twelve feet from the floor. From the bottom of this cut-out box a single run of conduit is led down the side of the column, and thence along a groove in the floor to the motor. All the wiring about the presses, between the main switch, the controller, and the motor is carried in iron conduit in such a way as to be thoroughly protected from mechanical injury.

The lighting of the plant is accomplished by means of constant potential enclosed arc lamps. Experience has shown that a very satisfactory illumination can be obtained by hanging a lamp in the middle of each bay and from every other roof truss. This makes each lamp supply light to a floor space 29 by 32 feet. Where better illumination is required for any special work, incandescent drop lights are placed, and sometimes, as upon the presses, portable incandescent lamps, with an allowance of cord, are provided.

The arc lamps are controlled by double-pole 220-volt snap switches carried on slate bases, securely attached to the side of the iron columns. The wiring to and from the switches and to the arc lamps is run in iron armored conduit fastened to the columns, and to the under side of the roof trusses. At every lamp opening the conduit contains a tee looking down, and to this tee is screwed a short nipple carrying a hook upon which the lamp is hung. By this method of installation the wires are entirely concealed. Each set of four lamps is protected by a cut-out placed in a manner similar to the ones protecting the motor leads.

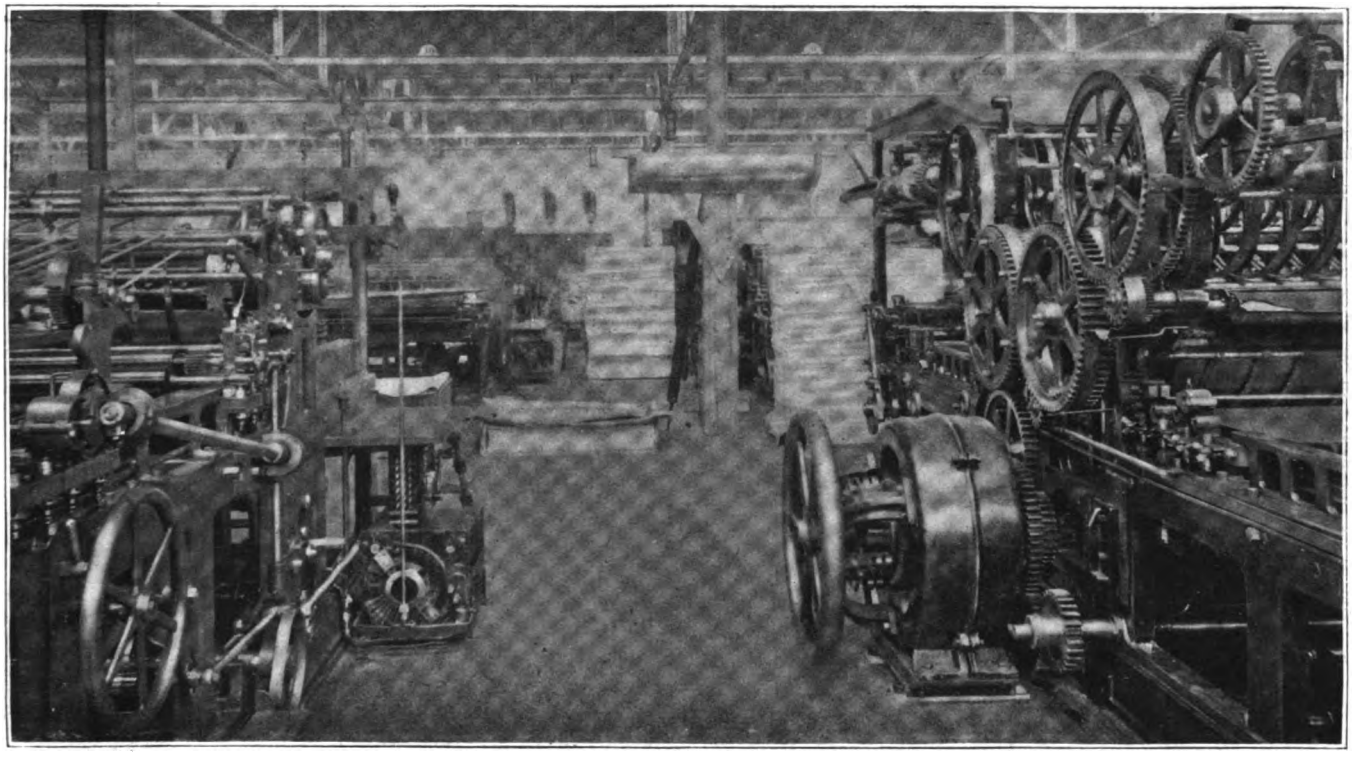


FIG. 4.—VIEW IN PRESSROOM, SHOWING DIRECT-CONNECTED MOTOR AND SPECIAL CONTROLLER.

There are installed in the plant at the present time a total of 95 motors of a total of 321 h. p., distributed as follows: Electrotype foundry—17 individual motors, belted or geared to dovetailing machine, trimmers, planers, roughers, saws, routers, black-leaders, moulding machines, beveling machines, blowers and jig saws, 21 h. p.; 1 direct connected to electroplating dynamo, 10 h. p. Bindery—15 belted to shafting driving folders, book-covering machines, Fig. 5, trimmers, wire stitchers, sewing machines, case makers, embossers, rounding and backing machines, 52 h. p.; 2 direct connected to shafting driving cutters and smashers, 10 h. p.; 8 individual motors belted to knife grinders, tying machines and gluing machines, 18.5 h. p. Stock room—2 belted to shafting, driving cutting machines, rotary board cutters, grinding machines, sizing machines and bevelers, 6 h. p. Heating apparatus—1 belted to blower fan to heat office, 12 h. p. Machine shop—1 belted to line shaft driving machine tools, 10 h. p. Composing room—1 belted to shaft driving typesetting and distributing machines, 3 h. p. Press room—6 belted to job presses, ink grinders and bronzing machines, 5.5 h. p.; 41 directly attached to presses, 173 h. p.

Digitized by Google

The motors throughout are of the Lundell type, made with one field coil which is entirely protected by the form of the field casting. The armature is of the ironclad type with removable form wound coils. The motors have a steady neutral point of commutation and do not spark under sudden changes of load. The motors directly attached to the presses and shafting are mutipolar, narrow in width, with a relatively large circumference of field frames. The commutator, like the armature, is narrow and of large diameter, with a large number of bars.

There are various considerations which usually determine in each case whether a motor should be belted, geared, or directly

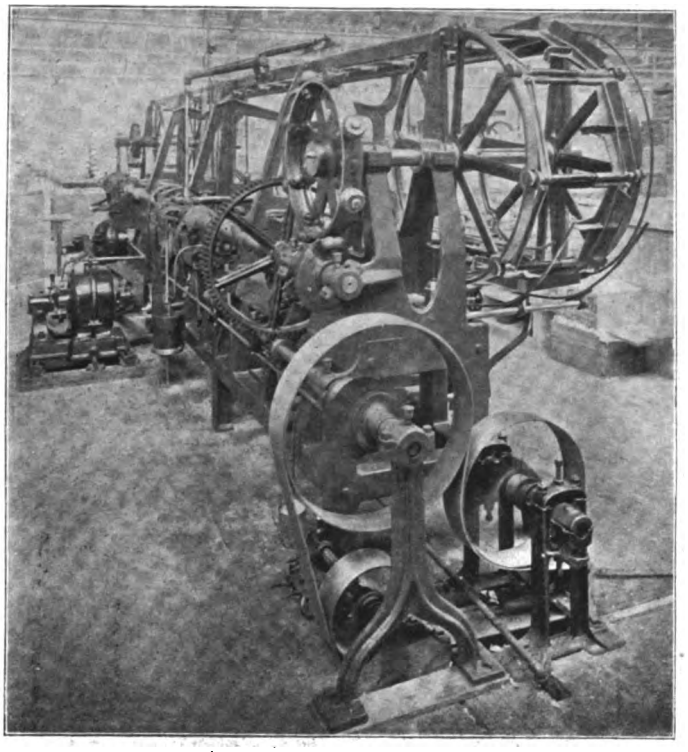


FIG. 5.—BOOK COVERING MACHINE DRIVEN BY LUNDELL MOTOR.

attached to a machine, or perhaps indicate that the machine should be grouped with others of its class and driven from a common shaft. For instance, there are certain classes of machinery, etc., which take but a very small amount of power, which are each in operation almost continuously, and which can be arranged in rows convenient to a line shaft. There are few, if any, advantages to be gained by driving such machines with individual motors, and especially is this the case when the driving shaft can be placed below the floor, as is done in the plant under consideration. The machine belts pass directly down through the floor to pulleys carried upon a shaft supported by floor stands bolted to planks in the bottom of the shaft pit. This pit is built with a concrete bottom and brick side walls, and is covered with the floor built in sections, so that it can be removed for purposes of inspection and oiling. The shaft is driven by a belted motor set upon a stand at the wall end. This motor rack is made of 3 by 3 timber, securely bolted together, and fastened to the floor. Underneath the motor and between the legs of the rack is placed the starting box. This box is mounted on a slate base, which also contains the main line switch, and the fuses for the protection of the motor. Each box is also provided with an overload attachment which will break the circuit in case of an excessive current. As a rule the motors belted to a line shaft in this way are shunt wound and run at a speed of 1,000 r. p. m.

It may seem strange, in view of the admitted losses in line shafting, that any shafting whatever was allowed in the plant, but when the inefficiency of very small motors and their comparatively large cost of installation is considered, reasons will not be found lacking for putting a limit on the tendency toward individual machine driving. In some cases, such as paper cutters, smashers or embossing machines, which depend largely upon the inertia of their moving parts to furnish the power for their operation, a decided advantage is gained by having a number belted to a line shaft, and thus operated by a common source of power, for under such conditions each machine gets the benefit of the stored momentum of the fly wheels of the entire line. On the other hand, there are machines which may take a small amount of power, but which are in operation only intermittently, or perhaps cannot be conveniently located in positions to be belted to a line shaft. Such instances are found in the electrotype foundry, Fig. 6, where there are numerous small machines, each with its individual motor, belted or attached by gearing.

The method of driving the large presses, however, presents the most problems. Here the conditions of operation leave but little doubt that individual motors should be provided. But whether to belt, gear, or direct connect the motor to the press is the problem. The belted equipment is the cheapest, the easiest to buy and install, and the more convenient to repair, as an injured motor can be quickly replaced. The higher speeds at which they run furnishes a certain amount of inertia to carry the press over "centres" of each impression. The belted motor takes up valuable room, however, and as it must be protected, it usually presents an unsightly appearance. The geared motor can be installed in most cases, and is an improvement over the belted type, though the increased cost of its installation makes its advantage a doubtful one. The directly connected motor takes the place occupied by the driving pulleys of a belt-driven press, and thus has the advantages of neatness and compactness. As presses are usually built, the main driving shaft makes five revolutions to every impression, so that a press operating at 1,440 impressions per hour requires a direct connected motor running at 120 turns per minute. This slow speed means a large

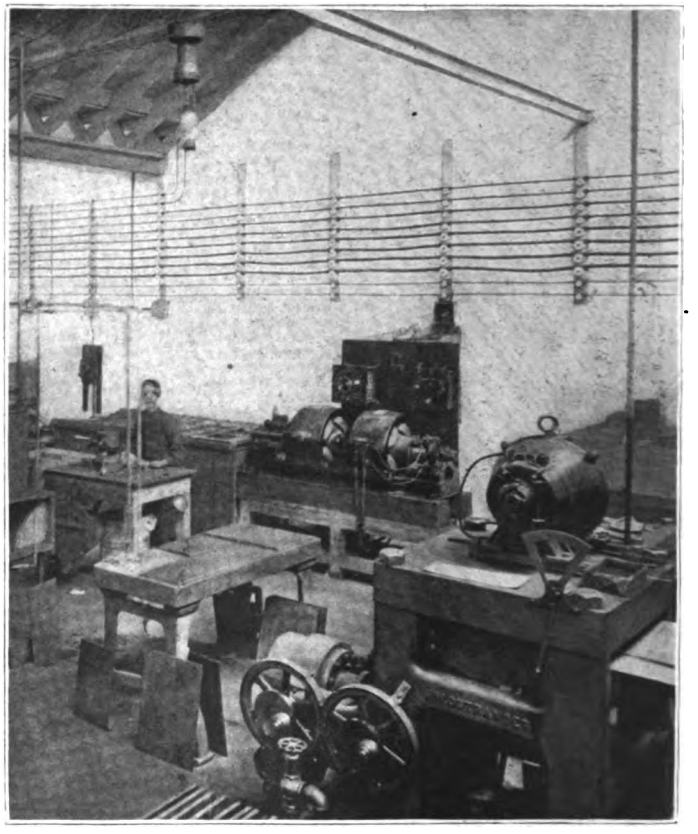


FIG. 6.—ELECTROTYPING ROOM.

and comparatively expensive motor. Its armature must be keyed directly to the press shaft, and this often means that the shaft of the old press must be taken out to have an extension welded upon it. The slow speed of the armature prevents the accumulation of energy to help the press over the centres. In spite of these disadvantages, however, the improvement in the mechanical design of the equipment with direct connected motors over the belted or geared arrangements and the longer life of the slower running motors were thought to be sufficient to justify the extra investment, and, therefore, motors directly connected to the forty-eight presses were installed.

Digitized by Google

The control of the press motors present a number of difficulties and the solution which has been worked out in this case may prove of interest. A printing press controller should have a handle placed within easy reach of the feeder by means of which the press can be conveniently started and stopped. In case of a failure of the current from any cause the controller should be automatically released so as to return to the "off" position. It should have a locking attachment so that the press room foreman can adjust the press for a certain number of impressions per hour and then leave its operation to the feeder. This locking device should not interfere with the stopping or starting of the press, but should insure that while the press is in operation it will be running at the predetermined speed. With ordinary electric press controllers the convenience with which the feeder can change the speed of his motor is a temptation to "soldier" when not working directly under the eye of the foreman. The controller should provide for at least two back-up speeds and should have a handle on the side of the press opposite the feeder, by means of which the press can be run slowly in either direction in "making ready" operations.

The most important requirement, however, is to secure a wide range of speeds for the press. For instance, it is sometimes desirable to be able to operate a press at a number of speeds ranging between 1,000 and 2,000 impressions per hour. This means that the motor should be controlled between 84 r. p. m. and 168 r. p. m., or that its lowest speed should be 50 per cent. of its highest speed. Now the speed of an electric motor may be varied in three different ways: (1) resistance may be inserted in series with the armature; (2) the intensity of the field magnetism may be changed, or (3) the external potential applied to the motor may be altered. The first method is uneconomical and unsatisfactory in operation, as it results in an unsteady speed under such a variable load as is given by a printing press. The second method, while more economical than the first, is limited in its application, for the speed of a motor cannot be satisfactorily controlled in this manner beyond the limits of about three-quarters of its full speed. To extend this range of speed and insure sparkless operation at the higher limits when the field is weakened means a large and expensive motor. The third method requires complicated generating machinery and distributing circuits, and if but two voltages are used (one twice the other) the system will not secure the range of speed desired.

The system of control adopted for this plant combines the first two methods. Between full speed and seventy-five per cent. of full speed the speed variations are secured by changing the field magnetism. This is accomplished by cutting in or out sections of the series field winding. Between three-quarters speed and one-half speed the various steps are secured by inserting resistance in the armature circuit. Three-quarters speed is taken as the average or "normal" speed of the press, and at this point all series field coils are cut out and the motor is operated as a straight shunt machine with no resistance in series with its armature. In this way the main controller provides for ten variations in speed; five of which are secured by armature resistance and five by field commutation. An auxiliary resistance box is placed on the motor or adjusting side of the press by means of which ten additional speeds can be obtained between any two of the main controller speeds, so that this method of control secures one hundred different speeds and it is, therefore, possible to operate the press with a fine adjustment and always at the highest rate which the character of the work will permit.

The diagram of the controller connections is shown in Fig. 3, and the construction of main controller in Fig. 4. The steel rod passing down from the handle at the left of the press feeder, operates the contact arms by means of a bevel gear. These arms carry carbon brushes and passing over the segments cut in or out armatures resistance and series field windings. The contact arms are held in a semi-circular cast-iron connection which contains a series of small holes corresponding to the number of speeds secured by the controller. Pivoted at the centre is a movable arm fitted with a handle and pin which can be made to enter any one of the ten holes. When the current is turned on and the controller revolved this arm moves around until it engages a pawl operated by an electromagnet. As long as the current is passing through the motor this magnet holds the controller in position, but it will release the arm as soon as the current is interrupted, and a strong spiral spring on the controller rod immediately brings the arm back to the "off" point. The "automatic" device is thus secured, while the locking feature is obtained by means of the movable arm which can be set at any hole corresponding to any desired speed. The hole corresponding to the "normal" speed is marked and the press is usually operated on this point.

On the right of the feeder is placed a small panel board containing the main line switch. A circuit breaker and fuses for protecting the motor. The switch is of the "tumbler" type and is connected so that when thrown up it connects the motor ready for operation. When this switch is opened an extension of each blade makes a contact with the lower clips so as to short circuit the shunt fields of the motor through a non-inductive resistance, providing a path for the field discharge and thus avoiding the danger of a puncture. The circuit breaker is adjustable through a wide range, and is of the "time limit" type. In this type the acting magnet is shunted by an exposed coil of high resistance wire. If an excessive current exists for a short length of time the shunted current flowing through this exposed coil heats the wire and thus sends a larger proportion of the current through the magnet windings and the circuit breaker acts. Momentary currents, such as occur upon starting the motor or when it is loaded heavily for an instant, are not supposed to open the circuit breaker. Unfortunately the feeder soon discovers that the circuit breaker can be adjusted to such a point that it will bother him by operating only at long intervals, and at this point he leaves it. Practically then the motor must be protected by fuses which cannot be adjusted. These fuses are of the enclosed cartridge type and are placed in both sides of the circuit, one being located on either side of the main line switch upon the panel board. The appearance of the controller and panel board can be seen on the press in the foreground of Fig. 4.

By means of a lever and arm which passes through the bottom part of the press, the controller can be operated from the opposite side, and the press can be run slowly in either direction in "making ready" without tugging at a belt or without the assistance of the feeder. Push buttons are located at convenient places about the press frames with circuits connected so as to shunt the "automatic" magnet attachment and thus the press can be quickly stopped from any one of a number of points in case of accident.

It is needless to point out that such a model printing establishment as has been described would have been impossible with the old method of transmitting power by means of belts and shafting. The successful operation of this plant is such an emphatic argument in favor of the electrical method of operation that it may well be worth our time to note some of the advantages which have been secured beyond those which go without the mentioning.

The absolute control of the presses, with their easy and convenient manipulation, when "making ready," and their wide range of speed, allowing them to be run at their fullest capacity, has a great influence in increasing the output of the plant. When a machine is not in operation it is immediately shut down and there are, therefore, no "stand by" losses outside of the engine room.

The most important advantage, however, is the saving in fuel. The result of the operation of the new plant is that only about one-third of the amount of coal is burned that was required before the move was made. A part of this saving must be attributed to the design of the power plant, with its modern equipment, so that just how much economy has been gained by the operation of the purely electrical part of the plant cannot be definitely determined.

The Corliss engine was furnished by the Atlas Engine Company; the motors by the Sprague Electric Company; the motor controllers and starting boxes by the Cutler-Hammer Mfg. Co., and the switchboard and wiring by the Western Electric Company.

Mr. George C. Nimmons was the architect of the building, Mr. Bion J. Arnold, consulting electrical and mechanical engineer, Mr. Thos. Sheehan, mechanical superintendent. Much of the success of the enterprise is due to the energetic management of the president of the company, Mr. W. B. Conkey.

LONDON, ENGLAND. It is said that a body of capitalists and others in London propose to introduce the trolley system there, if possible, and that Mr. Albert Johnson is there in consultation. The service is badly needed.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Bet4 Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 9, 1898.]

Vol. XXVI. NEW YORK, NOVEMBER 17, 1898. No. 550.

Prices for City Arc Lights.

INQUIRY having been made of us as to the new contract for city lighting in Boston and the data upon which it was based, we may say with reference to that interesting and important subject, that the agreement was entered into last August and runs for ten years, as already noted in our columns. It provides for the use of enclosed arc lights of 2,000 c. p. and the scale of rates is as follows:

Number of lights.	Price per night. Cents.	Price per year.
Not less than 2,365 nor more than 2,749	35	$127.75
" " " 2,750 " " " 2,999	34½	125.92
" " " 3,000 " " " 3,249	34	124.10
" " " 3,250 " " " 3,499	33½	122.27
" " " 3,500 " " " 3,749	33	120.45
" " " 3,750 " " " 3,999	32½	118.62
" " " 4,000 " " " 4,249	32	116.80
" " " 4,250 " " " 4,499	31½	114.97
" " " 4,500 " " " 4,479	31	113.15
" " " 4,750 " " " 4,999	30½	111.32
" " " 5,000 " " "	30	109.50

This scale is subject to submission to arbitrators and to revision in favor of the city from time to time, if investigation shows the prices to be capable of reduction, due allowance being made for not less than 7 per cent. for depreciation and 6 per cent. for fixed charges. These arbitrators have the ability to force on the company the adoption of any new system or device that shall have shown itself useful as a means towards the reduction of cost.

This is certainly a notable and remarkable contract, breathing the spirit of equity, and embodying to the full all those modern ideas which regard corporations no longer as bodies of men allied solely for purposes of mutual profit but as servitors of the public protected and fostered only so long as the State can derive direct as well as indirect benefit and recompense as a partner in the concern. Aside from these politico-economic and philosophical points, however, there is some very practical satisfaction in the evidence that the contract was warranted by, if not indeed largely based upon, the report of ex-Mayor N. Matthews, Jr., employed as special counsel by the city to tell it how much it ought to pay for electric lighting. That gentleman made one of his thoroughgoing studies of the question, and reinforced his own conclusions by the advice of acknowledged and disinterested experts. What he informed his successor, the Mayor of Boston, was that the average price per light per annum is $127.25; in the case of the Detroit municipal plant, with its expenses reduced to a commercial basis, and corrected for the conditions obtaining in Boston, the price would be $134.57. In the case of the Chicago municipal plant, corrected in the same manner, $154.80. For the Chicago Edison Company the figures are $129.20 and $128.43 for the underground and overhead contracts respectively; St. Louis gets its light for $99.67 on the corrected basis; Cincinnati for $110.89; Baltimore $154 for street lights and $122.68 for park lights; in Philadelphia the corrected average price is $143.33, and in New York it is $139.90. Mr. Matthews therefore holds that the price charged in Boston, namely, $127.75 for street and $124.10 for park lights per annum, or when all the differences in local conditions capable of being represented in dollars and cents are taken into account, slightly lower than the cost on a commercial basis of the lights furnished by the municipal plant in Detroit and considerably lower than the cost on a commercial basis of the lights furnished by the municipal plant in Chicago, is very fair to all parties. The prices are considerably higher than the prices charged by the Missouri Edison Co., of St. Louis, and the Cincinnati Edison Co., and slightly higher than those charged in Baltimore by a new competing company for park lights. The summary comes out as follows:

SUMMARY.

City.	Price per light per annum corrected for conditions obtaining in Boston.
Boston (average price)	$127.25
Detroit municipal plant (on commercial basis)	134.57
Chicago municipal plant (on commercial basis)	154.80
Chicago (company) (underground contract)	129.20
Chicago (company) (overhead contracts)	128.43
St. Louis	99.67
Cincinnati	110.89
Baltimore, street lights	154.08
Baltimore, park lights	122.68
Philadelphia (average price)	143.33
New York	139.90

Of course, in preference to this equitable and surely satisfactory contract, Boston might have put in its own plant after going through the conditions required by law, but it has most wisely decided not to venture into that uncertain investment. It finds warrant for such decision in some figures compiled recently by Alderman Wesley Sears, of Jackson, Mich., and presented prominently in the October issue of "City Government," a journal which has certainly no bias towards private companies. Mr. Sears tried hard to get all the data he could about municipal plants, and he gives a lot of it, but the comments that came in are even more interesting and striking than the figures. For example, Bloomington, Ill., says: "We figure no depreciation; neither do we figure interest, because," etc. What a fool's paradise those city officials must live in! Crawfordsville, Ind., says: "We do own our light, but if we did not, we would not, for in my opinion it will bankrupt us." Michigan City, Ind., says: "The time our city owned the electric light plant, it was run in connection with our waterworks. It was run very unsatisfactorily, and the plant had run down. Our council thought it best to sell. We got $3,000 for same. Think original cost was $8,000." And so it goes.

Mr. Tesla and the Czar.

THE personality of Mr. Tesla is one of the most fascinating in the field of modern invention, and his work is such as to command the interest of both the lay and the scientific public whenever he chooses to give details of his investigations and researches. If he had never done more than develop the theory and practice of the multiphase system, his life would have been useful above the ordinary; and even should it happen that none of his other ideas ever get into practical shape, his discoveries in electricity must always be regarded as important. We cannot number ourselves among those who, like the distinguished scientists, Profs. Brackett and Dolbear, quoted in our columns this week, are impatient with his tendency to let imagination outrun achievement and who virtually class him as a humbug. Mr. Tesla fools himself, if he fools anybody, when he launches forth

Digitized by Google

into the dazzling theories and speculations associated with his name. That he should desire to benefit the human race in ways now unknown, and should avow out loud belief in his capacity to do so, is surely not discreditable, any more than it is unworthy in the head of his own poetic Slavic race to propose the disarmament of the world. Granted that there will still be wars, and granted that all these wonderful visions of new arts in peace do not fructify without the work of a score of later geniuses, why find fault either with the Czar or with Mr. Tesla? Their aims appear wholly noble, their thoughts are beautiful, and if they fail, as they probably will in some material and vital respects, the world is certainly none the worse off for what they actually accomplish.

Just of late Mr. Tesla has been giving publicity to some of his newest work, and it is peculiarly interesting. We should have been glad, personally, to see him finish up some of the many other things that have occupied his energies these ten years past, but none of which now claim any place. For example, his "oscillator," or combination of generator and steam engine, which was to wipe out all other methods of power generation and reduce vastly the cost of power, by steam and electric economies. The very name is now bestowed by Mr. Tesla on another piece of apparatus, and though illustrated in detail and brought before the Chicago Electrical Congress in 1893, the "oscillator" of the original brand is, for aught the public knows, in the scrap heap. Yet it was a lovely invention, of infinite possibilities. We can only regret its neglect and oblivion, but if Mr. Tesla has other things more appealing to his mind for the present, that is his own business.

Of late also Mr. Tesla has brought forward another plan of power generation and transmission. At one period he expressed his belief in ability to disturb the earth's charge and thus send currents through the earth. That does not appear to be so feasible or attractive now as the idea of using the upper strata of the air which he says have a very superior conductivity. He would tether up aloft balloons in those strata and deliver to them large quantities of current at such high potential that it would travel economically across the space without wires, say from Niagara Falls to Paris. By this facile distribution of water power, coal and steam would become unnecessary to industry. The new plan may explain why Mr. Tesla has abandoned his old steam oscillator. It is earnestly to be hoped that this novel idea will prove workable. Balloons were a dismal failure in our late war, but that is no criterion, and Mr. Tesla may have some superior gas for inflation and sustentation purposes. It will be remembered that Mr. Marconi has already telegraphed from balloon to balloon, without wires, a distance of over twenty miles, thus proving in advance the tenability of Mr. Tesla's proposition.

The tremendous hold that war has taken upon the public mind is shown by the fact that even a genius of Mr. Tesla's independence is compelled to invention in that field. A patent issued to him last week intimates that he believes that torpedos and torpedo boats which were so utterly useless and unmanageable in the late conflict with Spain can be made more valuable if controlled entirely from shore, by a Navy Board, and without any crew. Last spring the ability to explode floating torpedos under ships from a distance without any wires was brilliantly demonstrated at Madison Square Garden several times a day for a month. Taking that idea, Mr. Tesla has applied the same principle to the electro-mechanical steering of torpedos, just as it is now done with several types, but, of course, in his case, without the intervening wires from shore. He is very sanguine that this will stop war, and we pray heartily that it may. The article or patent digest we print in this issue on the subject suggests improvements of his on existing apparatus that may render it, in spite of its great delicacy, able to evade jarring and jolting, the perils of the open sea, the defensive network crinolines around the ships, the concussions of great guns, and the intentional explosion of defenses placed in its way thus to derange and negative its operation. During the late war, apparatus far less sensitive than coherers was rendered useless by the firing of the heavy artillery on the ships, and it must be a preternaturally tough coherer that would escape the same fate. So also it must be a very difficult problem for which Mr. Tesla cannot suggest half a dozen diagrammatic solutions.

While all these curious things are "in the air," so to speak, it is a distinct pleasure to be able to print, as we do in this issue, Mr. Tesla's able and thoughtful paper read before the Buffalo meeting of the American Electro-Therapeutic Association. It compensates for the disappointment experienced from his unfinished lecture two years ago before the New York Academy of Sciences, which has never found its way into print, but of which the opening passages indicated the covering of the same ground. We trust that the data given by Mr. Tesla may stimulate our medical friends to greater employment of electricity. It is unfortunately true that disastrous results from injudicious use by some of them of Prof. Röntgen's great discovery of the X-ray have made medical men fight shy of handling electricity themselves lately, and we do not know whether Mr. Tesla's experiments will altogether reassure them, so striking and farreaching are they. But the saving of human life is a sacred thing. Every means and instrumentality must be tried by the surgeon and the physician, and it is devoutly to be hoped that having stopped the slaughter due to war Mr. Tesla will revert at some time to this brilliant paper and give the doctors apparatus that will help prevent the slaughter due to accident and disease.

It is not our desire to pose as apologists or publicists for Mr. Tesla. He needs no assistance of that kind; and so long as he commands freely whole pages of the Sunday papers, for which Mr. Wanamaker pays gladly his thousands of dollars, the technical and scientific journals have, indeed, little to do with the matter. All we wish to say is that it is not fair to condemn, as so many do, Mr. Tesla as visionary and impractical. No man has finished his work till he is dead, and even then there are long, long centuries in which his ideas can prove themselves true. The visionaries are thus often, in the end, the most sordid of realists—something Mr. Tesla will never be.

A Timely Warning.

IN our columns last week we printed an abstract of a very interesting paper read before the International Association of Fire Engineers, at St. Louis, by Capt. W. Brophy on the serious fire dangers of apparatus for showing animated pictures, which recalled to our minds the terrible Paris calamity of a few years ago. That this warning of Capt. Brophy, who has made the subject of fire protection a life study, is a timely one and deserving of immediate action on the part of local authorities, was evidenced last week by a fire in Huber's Museum and Theater, New York City, caused by the burning out of a fuse in a cinematograph. At the time the fire was started, about two thousand persons were in the building and it seems a miracle that no one was seriously hurt in the panic which resulted and which quickly emptied the house. It was a serious lesson, however, for the Board of Fire Underwriters, who should insist, as Capt. Brophy stated, that in the wiring of these machines and their construction the rules in the "National Code" must be complied with.

THE recent treatment of their employés by many companies during the war with Spain bore evidence, if it were needed, that there are corporations with souls. Such instances of patriotism and generosity were numerous. In the case of the Chicago Edison Co. not only were the men who went to the front carried on the pay rolls, but when they came back the president—an Englishman, at that—gave them a rousing banquet at his own expense. Now, during the yellow fever troubles down South, we note corresponding action on the part of the Postal Telegraph Co., which has made personal to itself the welfare of every one of its employés stricken down at the post of duty and has provided all medical aid and every needed comfort. It has, we understand, gone even further than that, but this record of fact will suffice to show how humane are the sentiments pervading the management. The company has sought no publicity in this respect, but that simply adds to the merit of this action. So shines a good deed in this suffering world.

AN item has been in circulation to the effect that Mr. Thomas A. Edison is going to make a trip to Russia, where several learned societies are waiting to do him honor. We have no doubt as to the attitude of our Russian friends, but the item is not true. We have been requested to make a positive contradiction of it in Mr. Edison's name, and now do so. Mr. Edison not only is not going to Russia, but he has no idea how the story originated.

Digitized by Google

The Multiple Unit System.

BY J. R. CRAVATH.

As there seems to be an impression in some quarters (judging from the article by E. M. Shepard in The Electrical Engineer of November 3, and the letter from Sargent & Lundy in the same issue) that I have been trying to attack the Sprague multiple unit system of train propulsion for elevated roads, I wish to say that no attack was intended by me in the article which caused this disturbance.

The Sprague multiple unit system stands without any practical competitor whatever for elevated roads on which the owners may desire to maintain a schedule of 15 miles per hour and over with trains of over four cars and stations about 2,000 feet apart. As it is to be presumed that these are the conditions that must be met by the electrical equipment of the South Side Elevated Railroad of Chicago in the not very distant future, it would evidently be out of place to question the wisdom of its adoption on that road.

For trains of four cars and less and for schedules of 17 miles per hour and under in ordinary elevated service, the multiple unit system and single motor car or locomotive systems come into competition, and there is room for a comparison of merits. I do not care to enter into such a comparison in the present article, but will simply touch on a few of the points brought up by Mr. Shepard, most of which points are entirely correct, but some of which it seems to me will bear modification.

In regard to the statement of mine about the lower efficiency of the small motors in a multiple unit system as compared with an electric locomotive I referred mainly to their lower efficiency after the period of acceleration is over and when they are working on a load consisting of train friction only. While the correct way to operate is of course to cut off current after the train is up to speed and "drift" to the next station, yet this is often not done, especially when making up time and during rush hours. The amount that this is done will be an important factor in determining the relative energy required per car mile with the multiple unit and locomotive systems. Mr. Shepard's statement that elevated railroad service is essentially acceleration does not take account of the fact that with the schedules under consideration there is always a considerable period between the time the train is up to speed and the time brakes are applied,—assuming of course that the acceleration is, as it should be, with either system, as rapid as the traction on the drivers will permit. Now motors built to exert the power necessary to accelerate a train rapidly are extremely inefficient and wasteful of energy when working on the light load of simply keeping a train in motion. While the energy needed to accelerate a train with the multiple unit system will be less than the energy required by the locomotive to accelerate the train more slowly to the higher speed necessary to maintain the same schedule by the locomotive system, there is quite a possibility that this difference may sometimes be more than compensated for by keeping the current on the multiple unit system after the train is brought up to speed, thereby resulting in a much greater waste of energy than by a similar performance with the locomotive motors; because the multiple unit motors are designed for higher acceleration and are consequently working on a lower relative load as compared with their capacity than are the locomotive motors, which are designed for lower rate of acceleration. Operated under theoretically perfect conditions the watt hours per car mile should be the lowest with a multiple unit train having all the axles driven, because the least energy would be required in acceleration, but such a plan would produce the lowest efficiency of any if the practice of drifting be not resorted to for the greater portion of the runs.

In other words, the comparative efficiency of the two systems in watt hours per car mile depends very much on the motormen and whether they are crowded to make the scheduled time. The practice of drifting is more essential to the success of the multiple unit system than with the locomotive. I do not speak of this as a defect in the multiple unit system, but simply as a fact liable to influence results, and which should be considered.

I recognize the fact now that I was in error in comparing kilowatt hours per car mile in service with kilowatt hours on special trial runs. Mr. Shepard has, however, made a still more serious mistake in quoting the kilowatt hours per car mile on the Metropolitan West Side Elevated Railroad for the month of February, 1898, without making deductions for a limited amount of car heating. Furthermore, the motors running on that road at that time were of too high speed and low torque to perform such an elevated service to best advantage, and economy. The figures for September, 1898, during which month there was no car heating and when slower speed motors were in use, are 2.47 kilowatt hours per car mile, as against 3.39 quoted by Mr. Shepard for February. The schedule time on the Metropolitan lines is as follows: Logan square line, 14.53 miles per hour; Lawndale avenue line, 14.66; Forty-eighth avenue line, 13.38; Western avenue line, 13.13. Thus, while the showing of the Metropolitan Elevated is not as bad as appeared from Mr. Shepard's quotation, the practical economy in kilowatt hours per car mile seems to be in favor of the South Side; and I apologize for any temporary injustice done to the Sprague system in that matter.

I cannot see why it is necessarily true that "electric locomotives with trains of varying size must work a considerable portion of the time below their efficient loads," as Mr. Shepard says. It is simply a question of proper method of operation. With a light train the current input to the locomotive during acceleration can be made the same as for a heavy train, with the result that the locomotive efficiency is the same and the acceleration much more rapid, thereby allowing more drifting for the same time-table.

Nor can I see why the cost of installation of power plants, including regulating batteries, is less for a given schedule with a motor equipment which is calculated to give a rapid acceleration than for one which can only operate at a lower acceleration. While the watt hours used in acceleration are less with the multiple unit system than with a locomotive for a given schedule, the maximum current is more by a large amount. Even though the time of starting is less with the rapid acceleration, it will often occur that several maximums will come at the same instant, resulting in lofty load peaks, which, though of short duration, require generating or storage apparatus to take care of them. The extra investment in this apparatus might, however, be compensated for by the economy in watt hour consumption in some or many cases.

A Trolley Road for Honolulu.

According to advices received from Honolulu a new traction company has been organized in that city. It is backed by influential merchants and will be known as the Honolulu Rapid Transit and Land Company. Its officers are: President, L. A. Thurston; vice-president, J. B. Castle; secretary, J. A. Gilman. The general manager, C. G. Bellentyne, is expected here about Dec. 15 to make purchases for the road, which is to be operated by electricity.

Electric Bus in Berlin.

An electrical omnibus has lately been put in service experimentally in Berlin. It has accommodation for twenty-six passengers, measures 23 feet in length by 6½ feet in width, while its weight, including the battery, is 6.65 metrical tons. The battery, which consists of 120 cells, contained in twenty-four boxes, weighs about 1¾ tons, and is stated to have a capacity sufficient to run the vehicle a distance of 60 kilometers (37½ miles) at a speed ranging from 6 to 12 kilometers per hour. The motor is geared to the front axle of the omnibus.

HAVANA, CUBA. The entire system of street railway in Havana, twenty-five miles of track, has been sold, it is said, to an English stock company for $1,600,000. The entire line will be rebuilt and the motive power changed to electricity.

BROOKLYN TROLLEY SUITS. There are 245 damage suits against the trolley roads of Brooklyn pending in the Brooklyn Supreme Court calendar. The total that is modestly asked reaches about $2,000,000. Lawyers say there are 2,000 cases back of these representing $20,000,000.

Digitized by Google

ELECTRIC LIGHTING.

The Baggett Fuse Repair Screw Driver and Portable Lamp Socket.

ANYONE who has ever been called upon to insert a fuse into a fuse block located on a ceiling or some other place, difficult of access, especially when the place was dark, has felt the necessity for a handy tool and a light to aid him in performing this tedious operation. Such a tool, which seems to fill this long-felt want most admirably, has lately been placed on the market by James N. Baggett, superintendent of the Bartow Electric Light Works, of Bartow, Fla., and is illustrated below.

It includes all of the requisites for enabling an operator to tap a live wire in order to give light during the making of branch connections and the effecting of repairs. It consists of a screw driver, shown in perspective in Fig. 2, which has a detachable base. The handle, which is hollow, contains the necessary fuses and clamps, shown in Figs. 1 and 4, for tapping the legs of the circuit. These clamps can be connected to the lamp-plug socket, which is the base of the handle itself, by means of plugs, and the operator by inserting a lamp into this socket will have the advantage of a light even during the operation of inserting a fuse. The manner of using the tool and attaching the clamps to the wires is clearly shown in Figs. 3 and 4. The tool has been constructed with the end in view of embodying in the smallest possible space all the necessary implements, and should find a ready market among wiremen and engineers.

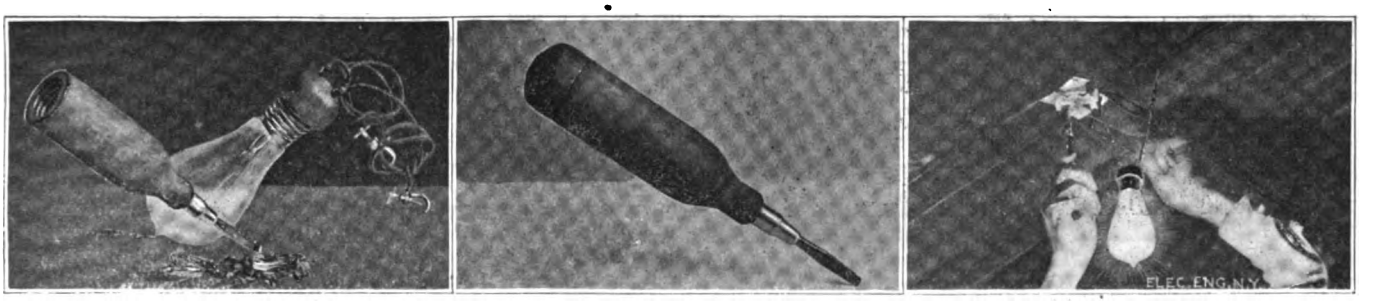


Fig. 1.—Cap Removed and Lamp Attached. Fig. 2.—Screw Driver with Contents Enclosed. Fig. 3.—Replacing a Blown Out Fuse.

BAGGETT FUSE AND REPAIR OUTFIT.

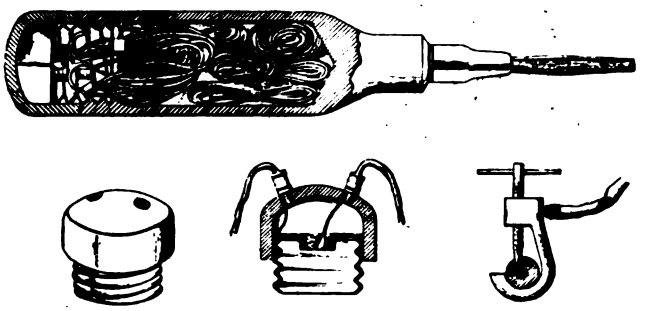


FIG. 4.—BAGGETT FUSE REPAIR SCREW DRIVER, CASE REMOVED. ALSO LAMP CAP AND WIRE CLAMP.

A RAT IN DUBLIN, by gnawing at the insulation on one of the cables, is said to have short-circuited a section of the electric lighting system. Its life was the penalty, but the cable would not appear to have been very heavily protected.

LITTLETON, N. H. The Littleton Water and Electric Light Company has utilized water power, putting in Rodney Hunt twin 39-inch turbines, developing about 359 h. p. under 18-foot head, and driving a plant of the Stanley two-phase system. The cost is about $25,000.

NEWS & NOTES

Tesla's Electrical Control of Moving Vessels or Vehicles from a Distance.

IN view of the public interest of late in anything which has a warlike appearance or apparatus tending to render war less probable by making it more horrible and destructive, and in view also of numerous recent disasters at sea, the current descriptions in the daily papers of a new invention of Mr. Tesla and reported interviews with him have been received with widely differing comments. In Mr. Tesla's own words, the invention consists of a complete and practicable solution of the problem of controlling from a given point the operation of the propelling engines, the steering apparatus and other mechanism carried by a moving object, such as boat or floating vessel, whereby the movement and the course of such a vessel may be directed and controlled from a distance, and any device carried by the same brought into action at any desired time. The system is based on the use, upon the object to be exploded or steered, of a Branly coherer and Marconi agitator of novel form, toward which impulses are sent from a Hertzian radiator. It will be remembered that this is what was done in a small but very successful way at the Electrical Exhibition in Madison Square Garden last May, when miniature floating torpedos fastened on a board floating under the bottom of model men-of-war were thus blown up daily, without wires, by means of the same "wireless telegraph" methods, from a distance of not less than 50 or 60 feet. Mr. Tesla's application is dated in July. It was one of the intentions at the exhibition to place all the receiving apparatus on the boat in the water; but for obvious reason pertinent to the locality it was found desirable to run the boat connections to a temporary shelf at the top edge of the tank and rest the cohering apparatus there; so that the floating mines or torpedos could be renewed frequently and also to prevent the boat from floating about, as one or two people were hurt by flying pieces when the explosions took place too near the sides. Another object was to prevent the continuous destruction of the coherers, being delicate and expensive apparatus then not readily obtainable. Mr. Tesla in his scheme embodies the idea of placing the coherer on the floating torpedo, and proposes that the impulses taken up by the coherer shall also operate steering magnets, as in other dirigible torpedos, such as the Sims-Edison, but without the wires to shore. This method he elaborates with wonted ingenuity, although he does not include the firing of artillery, which was also done last May at the exhibition, and of course might be done with equal facility on a floating ship, without wires from the shore; or on a submerged fort or an uninhabited monitor at a harbor entrance. His patent is limited merely, it would appear, to devices or mechanism for steering, and does not claim either the discharge of explosives or selective signaling, or other features of that kind.

Referring to Fig. 1, A designates any type of vessel or vehicle which is capable of being propelled and directed, such as a boat, a balloon, or a carriage. It may be designed to carry in a suitable compartment B objects of any kind, according to the nature

Digitized by Google

of the uses to which it is to be applied. The vessel—in this instance a boat—is provided with suitable propelling machinery, which is shown as comprising a screw propeller C, secured to the shaft of an electromagnetic motor D, which derives its power from storage batteries E E E E. In addition to the propelling engine or motor the boat carries also a small steering motor F, the shaft of which is extended beyond its bearings and provided with a worm which meshes with a toothed wheel G. This latter is fixed to a sleeve b, freely movable on a vertical rod H, and is rotated in one or the other direction, according to the direction of rotation of the motor F.

The sleeve b on rod H is in gear, through the cog-wheels H′ and H″, with a spindle G, mounted in vertical bearings at the stem of the boat and carrying the rudder F′.

The apparatus by means of which the operation of both the

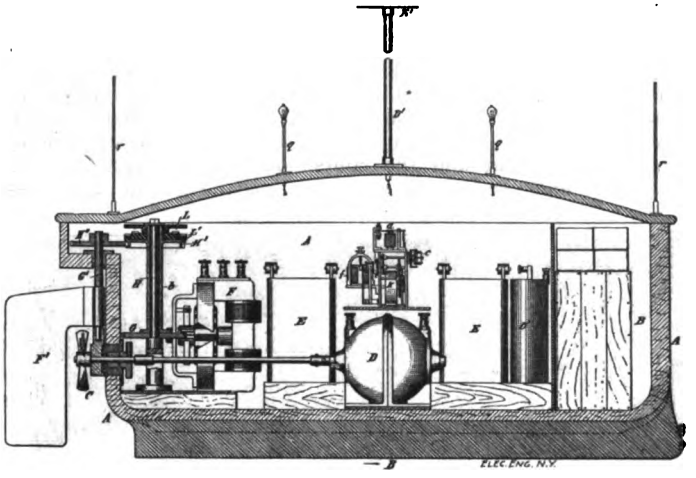


FIG. 1.

propelling and steering mechanisms is controlled involves a receiving circuit, adjusted and rendered sensitive to the influence of waves or impulses emanating from a remote source, the adjustment being so that the period of oscillation of the circuit is either the same as that of the source or a harmonic thereof.

The receiving circuit proper (diagrammatically shown in Fig. 2) comprises a terminal E′, conductor C′, a sensitive device A′, and a conductor A″, leading to the ground conveniently through a connection to the metal keel B′ of the vessel. The terminal E′ should present a large conducting surface and should be supported as high as practicable on a standard D′, which is shown as broken in Fig. 1; but such provisions are not always necessary. It is important to insulate very well the conductor C′ in whatever manner it be supported.

The circuit or path just referred to forms also a part of a local circuit, which latter includes a relay magnet a and a battery a′, the electromotive force of which is, as before explained, so determined that although the dielectric layers in the sensitive device A′ are subjected to a great strain, yet normally they withstand the strain and no appreciable current flows through the local circuit; but when an electrical disturbance reaches the circuit the dielectric films are broken down, the resistance of the device A′ is suddenly and greatly diminished, and a current traverses the relay magnet A.

The particular sensitive device employed consists of a metal cylinder, with insulating heads, through which passes a central metallic rod. A small quantity of grains of conducting material, such as an oxidized metal, is placed in the cylinder. A metallic strip, secured to an insulated post, bears against the side of the cylinder, connecting it with one part of the circuit. The central rod is connected to the frame of the instrument and so to the other part of the circuit. This instrument, which is similar in construction to the ordinary Branly coherer, differs from it only in the method used for restoring the particles to their original position after each impulse. Mr. Tesla uses for this purpose a spring device operated by the armature of an electromagnet. This is said to overcome all serious defects caused by the unequal size.

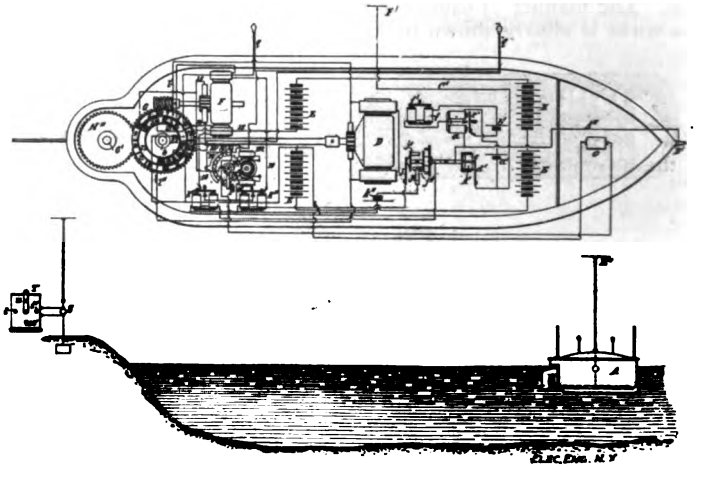
To do away with the defects in the sensitive device, Mr. Tesla makes the particles by a special tool, insuring their equality in size, weight and shape, and they are then uniformly oxidixed by placing them for a given time in an acid solution. This secures equal conductivity of their surfaces and stops their further deterioration, thus preventing a change in the character of the gas in the space in which they are enclosed. He prefers not to rarefy the atmosphere within the sensitive device, as this has the effect of rendering the former less constant in regard to its dielectric properties, but merely secures an airtight inclosure of the particles and rigorous absence of moisture, which is fatal to satisfactory working.

The normal position of the cylinder c is vertical, and when turned in the manner described, the grains in it are simply shifted from one end to the other; but inasmuch as they always fall through the same space and are subjected to the same agitation they are brought after each operation of the relay to precisely the same electrical condition and offer the same resistance to the flow of the battery current until another impulse from afar reaches the receiving current.

Referring again to Fig. 2, K′ K″ are two relay magnets conveniently placed in the rear of the propelling engine. One terminal of a battery k″ is connected to one end of each of the relay coils, the opposite terminal to the brush J′, and the opposite ends of the relay coils to the brush J and to the frame of the instrument, respectively. As a consequence of this arrangement either the relay K′ or K″ will be energized as the brush J′ bears upon the plate j′ or j″, respectively, or both relays will be inactive while the brush J′ bears upon an insulating space between the plates j′ and j″. While one relay, as K′, is energized, its armature closes a circuit through the motor F, which is rotated in a direction to throw the rudder to port. On the other hand, when relay K″ is active another circuit through the motor F is closed, which reverses its direction of rotation and shifts the rudder to starboard. These circuits, however, are at the same time utilized for other obvious purposes.

Mr. Tesla informs a "Herald" reporter that using his special apparatus for the production of electrical waves and impulses, he will operate from his laboratory in New York a model which he will exhibit at the Paris Exposition in 1900; from which it may be inferred that he does not expect immediate practical utilization of the idea beyond that with which the New York public has already been made familiar by the electrical exhibition of last May.

The reporters who have been allowed to enter the laboratory state that Mr. Tesla has there a model roughly outlined of a torpedo boat on stocks, the keel of copper plate, with rudder and propeller in the usual positions, and showing two small incandescent lamps on standards. With this he illustrates the operation of the steering gear and of the lights by means of the



FIGS. 2 AND 3.

apparatus for projecting and receiving the electrical waves or impulses. No details are given by them of the mechanism.

Discussing the subject Prof. C. F. Brackett, of Princeton University, says: "The shortest, most correct and most complete criticism which I can make in reference to this bold boast is that what is new about it is useless, while that which is useful had all been discovered by other scientists long before Tesla made this startling announcement. You will find the whole theory which he has applied in any up-to-date text book. What Tesla has done is simply to make theoretical application, which would prove to be absolutely ridiculous in application of inventions

Digitized by Google

which had already been discovered. There is nothing new about this. The theory is perfect, but the application absurd. So throughout Tesla's whole elaborate scheme, the theory is not at fault, although there is nothing original about it, but the circumstances under which its application would be necessitated are such that the only result would be failure. Do you suppose that in the din of battle it would be possible to put into execution those minute and carefully adjusted mechanical experiments, all of which are presupposed by his theory, which require the quiet of an uninterrupted laboratory to work successfully? Or do you think that the enemy would co-operate with the attack and place their vessels in exactly the correct position to be hit or that they would remain stationary while the torpedo boat approached? His theory would have to assume an affirmative answer in order to be a success, and moreover the torpedo boat would have to be seen from the base of operations in order to direct it. It would be discovered by the doomed vessel long before it reached its destination, and would be exploded on the spot, so how great an advance is this on the present mode of warfare?"

Prof. A. E. Dolbear, of Tufts College, Massachusetts, says: "This last so-called invention of Nikola Tesla's is a very pretentious affair, and it is so incredible that the story is not to be believed until the work is actually done. If Tesla said all that the 'Herald' quotes him as saying, then his whole scheme and his manner of working is unintelligible to me. He even says that 'this power can be exerted at any distance by an agency of so delicate, so impalpable a quality, that I feel I am justified in predicting that the time will come when it can be called into action by the mere exercise of the human will.'

"That is getting a little outside of science, but you will notice that Tesla himself is only predicting that this will come true. There has been no accomplishment. He proposes to do great things, but he does not tell how he is going to do them, and he hasn't done them himself yet.

"The announcement is most amazing, and, coming as it does from Tesla, scientists are all the more chary about accepting it. During the last six years he has made so many startling announcements and has performed so few of his promises that he is getting to be like the man who called 'Wolf! wolf!' until no one listened to him. Mr. Tesla has failed so often before that there is no call to believe these things until he really does them. Meantime, we are all waiting with much patience and without solicitude. We will believe them when they are done."

Regulations at the Paris Exposition.

THE entire space occupied by the Paris Exposition will be considered as a bonded warehouse, and foreign products forwarded to the exposition will enter France through all goods traffic offices. The sender will be required to forward a statement, which must be joined to the goods traffic receipt, and in which must be indicated the nature, kind, weight and origin of the products. All the shipments to the exposition will be subject to the conditions of international goods traffic or ordinary goods traffic, at the option of the parties interested. Shipments made by international or ordinary goods traffic will not undergo examination at the frontier of France. Sealing will be done free, and all shipments will be exonerated from statistic charges.

Foreign products received into the exposition grounds will be taken charge of by the special customs department of the exposition, and subject to the general rules of bonded warehouses. Any such products offered will not be taxed with more than a tariff applicable to similar products of the most favored nation. Objects manufactured within the limits of the exposition from materials of foreign origin imported under the customs régime will not be liable to any other duties than those pertaining to the manufactured materials.

The management of the exposition will take measures to protect against danger all objects exhibited. Exhibitors will be expected to insure their products at their own expense. On the other hand, the management will assume the responsibility for damage done to objects exhibited in the retrospective or centennial section, but only to the amount fixed by mutual agreement between the management and the exhibitors and entered on the certificate of admission. The management of the exposition will not assume any responsibility for thefts and robbery, but will organize a surveillance department to prevent robbery. Guards may be appointed by exhibitors, subject to the approval of the Director General's department. All guards or police will be required to wear a uniform or distinctive emblem, and will obey all rules and regulations of the management of the exposition.

Exhibitors will have all the rights and immunities granted by the French law of May 23, 1868, as to the guarantee of inventions liable to be patented, and also of manufacturing designs, within the delays and subject to the conditions of said law. No exhibitor will be required to pay any rent for space occupied in any of the palaces, pavilions or buildings erected by the management of the exposition, and all water, gas, steam and motive power necessary for working all apparatus and machinery exhibited will be supplied free of charge. Exhibitors, however, will be required to furnish at their own expense the necessary piping for receiving water, gas or steam; also the intermediary transmissions required for the reception of the motive power on the driving shafts or belts.

Exhibitors will be required to pay all expenses connected with packing, shipping, unpacking, storage of cases, placing objects on exhibit, repacking and reshipping. No exhibitor will be allowed to erect a private building until the complete plans have been submitted to and approved by the management of the exposition, and all earth work and gardening done by exhibitors must be at their expense, and only upon the approval of the management. No exhibitor, concessionaire or other person will be allowed to advertise within the limits of the exposition by means of posters, prospectuses, hand bills, etc., without authority and permission from the Commissioner General.

All industrial products admitted to the exposition must be placed within the exposition in the period from December 1, 1899, and February 28, 1900.

Exports of Electrical Material from New York.

The following exports of electrical material are from the port of New York for the week ending Nov. 1:

Africa—13 packages electrical machinery, $1,299. British Australia—32 packages electrical material, $1,179. British Possessions in Africa—16 packages electrical machinery, $7,450; 2 cases electrical material, $213. Bremen—4 cases electrical material, $255. Brazil—15 packages electrical machinery, $12,722; 105 packages electrical material, $3,242. Berlin—12 cases electrical material, $300; 3 cases electrical machinery, $893. Belfast—15 packages electrical machinery, $1,704. Bristol—1 case electrical material, $12. Central America—3 packages electrical material, $2,850. Dutch West Indies—1 package electrical material, $43. Florence—1 case electrical material, $31. Genoa—3 cases electrical material, $50. London—24 cases electrical material, $1,005; 117 cases electrical material, $6,065. Liverpool—5 packages electrical material, $170. Vienna—3 cases electrical material, $85.

The Louisville Experiments in Water Purification.

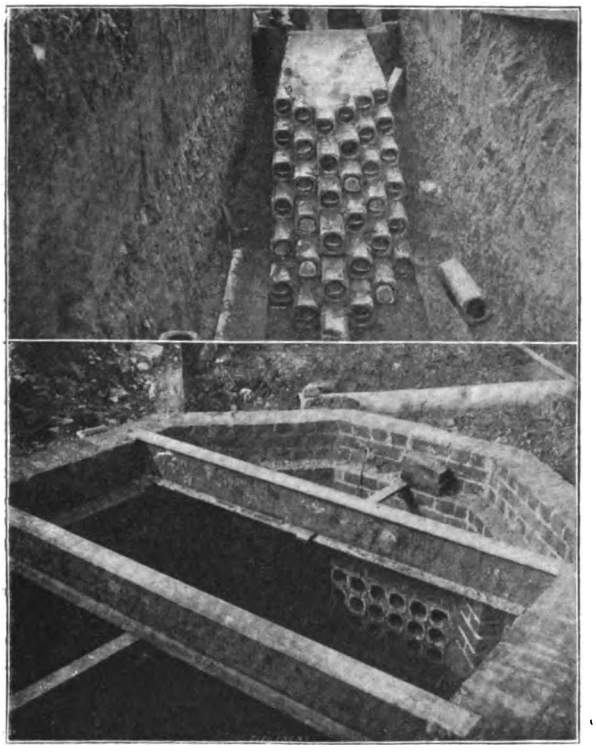
Data has recently been made public as to the various experiments for the purification of the water of the Ohio River at Louisville, Ky., where it is heavily charged with matter in suspension. Electrical methods were among those which were tried and are said to have failed. Discussing the report, the "Engineering News" sums up as follows: "Another confirmation of the opinions commonly held by disinterested scientists who have given the matter sufficient attention to warrant sound conclusions is that the direct treatment of water by electrical current is of little value. There were, however, such apparently good grounds for hoping that a coagulant might be produced by electrolytical, in preference to chemical, methods, that extended studies of the subject were made. Nearly all of the so-called electrical systems of water and sewage purification, it may be stated here, are such only in the electrolytical production of a coagulant at the purification works, and for immediate use, instead of buying it from a manufacturing chemist. The Louisville experiments showed that the cost of the electrolytical production of aluminum hydrate was not only excessive, but that this method was unreliable "on account of the very low and irregular formation of the hydrate." An iron hydrate could be produced much more advantageously than an aluminum, and would be somewhat cheaper, apparently, than commercial sulphate of alumina, but it could not be safely employed at Louisville, because the water there at times is too low in dissolved oxygen to oxidize more iron than an equivalent of three grains of sulphate of alumina per gallon, which would be insufficient.

Digitized by Google

If more iron were used it would appear in the effluent. Iron and aluminum, the report states, are the only metals available for the electrolytical production of coagulants. Neither of these hydrates when thus produced increased the hardness, corroding or incrusting qualities of the water, as does the commercial sulphate of alumina."

New Power Cable Conduit at Niagara.

THE Niagara Falls Power Company are building a new cable conduit eastward on their lands, reaching from the end of the conduit originally constructed to the works of the Union Carbide Company. This new conduit is of quite different construction from the section first adopted by the company, but like it, it will be of most substantial construction. For this new conduit vitrified tile ducts have been adopted, 36 of them being laid in a nest, and each tile being 3½ inches. The tiles were made by the H. B. Camp Company, and they are laid in a trench excavated to a depth of five feet. They are bedded in cement, the thickness of cement on the top and bottom being four inches, and on the side the sheet is two inches thick. The



CAMP CONDUITS FOR POWER TRANSMISSION AT NIAGARA.

space occupied by the tiles is two feet five inches. In the construction of the conduit the mandrels used were pulled about every third tile. The total length of the conduit now being built is 1,230 feet. Along the line of the conduit, at proper intervals, manholes are located. Each of these manholes is about eight feet deep, and built of brick. Piers are placed to support brackets for carrying the cables, and across the top of the manholes are two iron girders, placed there to support the covering. In shape the manholes are octagonal. Through the ducts, from manhole to manhole, No. 8 wires are run to facilitate laying the cables. The new conduit passes to the west and rear of the Mathieson Alkali Works, and thence back of the Niagara Electro Chemical plant to the carbide works.

Struck by Lightning Two Hundred Times.

A very singular record is attached to a deserted and ruined house at Dartmoor, England. It was built about forty years ago by a wealthy landowner, with the intention of making it his country residence; but before the building operations were completed a heavy thunderstorm broke over Dartmoor, and the house was struck by lightning, the roof being dismantled. The damage was repaired and the house quickly finished. No sooner had the owner taken up his residence in it than another violent storm struck the house and destroyed the chimney-stack, doing, besides, considerable damage. This made the owner nervous, and he left the house. It was soon shown that his fears were not groundless, for in nearly every thunderstorm that passed over the district the house has been struck, and a fresh portion of it destroyed. Altogether it has been struck over 200 times.

TELEPHONY AND TELEGRAPHY

New Postal Telegraph Headquarters in Kansas City, Mo.

THE whole of the third district of the Western division of the Postal Telegraph Cable Company is handled from Kansas City, Mo., which also generates a very large volume of telegraphic matter of its own. Hence the necessity for quarters that keep pace with the growth of the traffic and the opening of the fine new Postal Telegraph Building shown herewith. It is situated on the Southwest corner of Eighth and Delaware streets. On the ground floor at the corner, is located the local business office for the accommodation of the public, also the office of Manager Richards, together with the receiving and delivery departments. It is fitted up in antique oak throughout. In the public lobby is the Postal's well known trade mark worked out in blue and white tile, five feet in diameter, and forming an attractive centre for the lobby floor.

The receiving and delivery departments located here, are connected with the operating department on the fifth floor, by a system of pneumatic tubes operated by electric power.

The operating department, in charge of Chief Operator B. F. Rommell, impresses one. Current is furnished by motor

NEW POSTAL TELEGRAPH HEADQUARTERS, KANSAS CITY, MO.

dynamos. The old style glass partitions on the operating tables have disappeared. The "sounders" which click off the messages to the operators are no longer on the table tops, but are enclosed in "resonators." Another new feature is the absence of pens and ink wells—none are used. Every message is received from the "sounder" on to the typewriter.

All wires enter the building underground and are brought up to the fifth floor through a tile shaft provided for the purpose, in cables containing 50 wires each.

The electrical engineering in connection with the new office was under the supervision of Mr. F. W. Jones, chief electrical engineer of the company, and in the immediate charge of J.

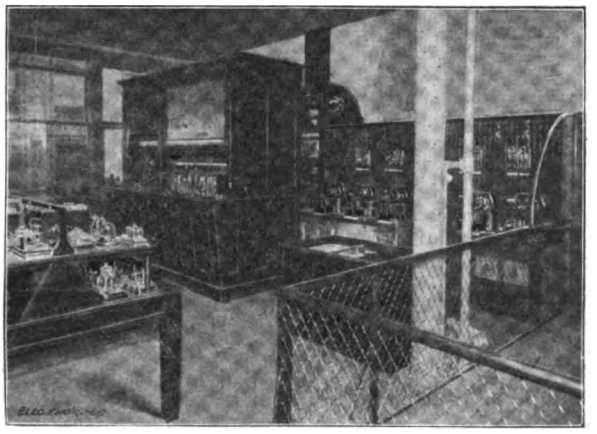
Digitized by Google

F. Butterfield, assistant electrical engineer of the company at Chicago.

Near the operating department, on the fifth floor, are the offices of the superintendent of the Third district, Mr. G. E. Paine, within whose territory lie the offices in the States of Kansas, western Missouri, southern Nebraska, Colorado, New Mexico, Arizona, western Texas and a portion of California.

Immediately behind the switchboard are the motor dynamos. In front of the switchboard is the "repeater" table, a long double decked table with glass partitions. Here are located thirty-two sets of repeaters. Another notable feature is the receiving terminal of the pneumatic tube system. All told the operating room has accommodation for 120 operators.

The special power plant of the system is operated by current from the Kansas City Electric Power Co. The dynamotors, as seen in one of our illustrations, are as follows: three Crocker-Wheeler 500 watts, 220 volts primary, 140 volts secondary; three Crocker-Wheeler, 500 watts, 220 volts primary and 250 volts secondary; three Crocker-Wheeler, 500 watts, 220 volts primary and 400 volts secondary. In addition to these are two General Electric, 1,500 watts, 220 volts primary and 50 volts secondary; two General Electric, 250 watts, 220 volts primary and 95 volts secondary; one General Electric, 1,000 watts, 220 volts primary



SWITCHBOARD, NEW POSTAL TELEGRAPH HEADQUARTERS, KANSAS CITY, MO.

and 120 volts secondary. In this manner with the dynamotors on the 220-volt circuit, a range of from 50 to 400 volts is obtained.

The Use of the Intercommunicating Telephone System in Large Offices.

THE necessity for intercommunication between the various departments and officers of any large establishment and the saving caused by the introduction of telephone devices for accomplishing this result, have induced telephone manufacturing companies to devise intercommunicating systems which would meet this growing demand. Some of these are automatic and frequently cause trouble and give bad service, others again are neither practical nor efficient; and many concerns, after having tried these devices, have unfortunately again returned to the central station service, which "does not fill the bill" for the purpose mentioned above. All these difficulties have been carefully studied for some time by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, and after a great deal of experimentation they have brought out a thoroughly practical and reliable intercommunicating system. One of the largest of these equipments installed lately by the company is in the new offices of the People's Gas Light and Coke Company, Michigan avenue and Adams street, Chicago. No better evidence than this plant could be cited to show the decided advantages of this system.

Fig. 1 is an interior view of the application offices on the main floor showing six private plant instruments, one at each application window and three telephones connected with the public exchange. Each office on this floor is furnished with an instrument consisting of a portable desk telephone and a 60-point plug box. Any one of these instruments can be directly connected with any of the instruments in the bookkeeping department, Fig. 2. Each bookkeeper's desk is furnished with a long swinging arm telephone and plug box, and any one of these instruments can also be connected directly with any of the offices on the main floor.

In this system the user is not required to first call an operator

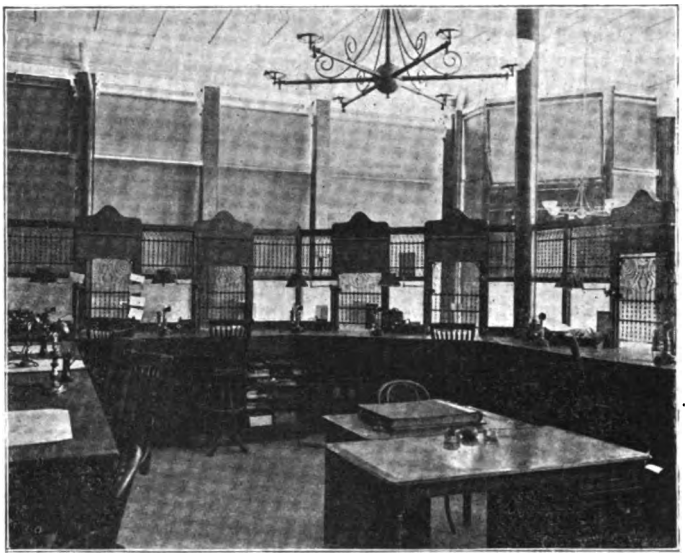


FIG. 1.—VIEW OF APPLICATION OFFICE OF THE PEOPLE'S GAS LIGHT AND COKE CO., CHICAGO, ILL.

at a central office, but completes the calling circuit to the station wanted by inserting the plug in the number desired, regardless of where the plug of the called instrument may be. In this way should a user neglect to disconnect an instrument when through, or fail to place the plug in the home number, it does not prevent that station from being called by another, as is the case in all ordinary strap-switch systems. The talking circuit is completed by the party calling placing the plug in the home number. In addition to this system between the bookkeeping department and the main floor offices, and entirely independent, there is a system of the same kind between the officers of the company and the heads of departments. There is a pedestal beside the desk in President A. M. Billings' private office, with a desk telephone and plug switch for the office sys-

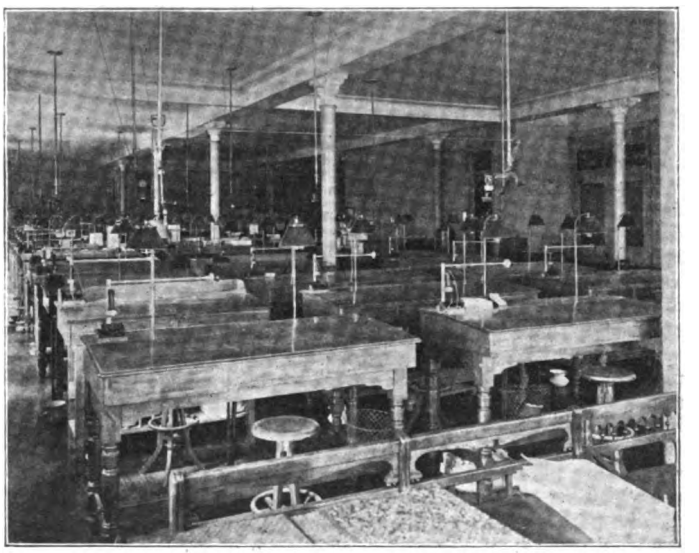


FIG. 2.—BOOKKEEPING DEPARTMENT OF THE PEOPLE'S GAS LIGHT AND COKE CO., CHICAGO, ILL.

tem and a telephone connected with the public exchange. The pedestals and instruments used in this system are the regular Stromberg-Carlson long distance type. The system can be equipped with a generator call bell or battery call, the latter where the distances are not too great, and where a large amount of outside construction is required. The generator call is con-

Digitized by Google

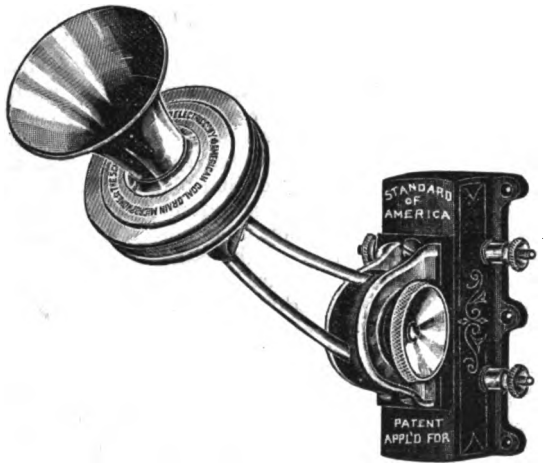
sidered the most satisfactory. In the battery call system, the ringing and talking batteries can be placed at the central office.

This entire intercommunicating system has been most carefully worked out by the company and is admirably suited for business houses, large residences, hotels, public institutions, factories and for connecting the various pumping stations in mines with the mills and offices. When once properly installed, it is claimed to require practically no attention. The circuits are so arranged that the objectionable cross-talk is prevented. This feature and numerous other valuable points make this well-developed telephone system well adapted for any place where rapid and accurate intercommunication is desired.

The Schmidt Movable Telephone Arm Without Connection Cord.

THE Schmidt & Bruckner Electric Co., of New York City, are now placing upon the market a new style of adjustable telephone arm, which embodies several new departures from the familiar black enameled arm, originating long ago with the Bell Co., and now so universally made by independent manufacturers. The principal objection to this type is the cord adjustment on the side. This has been the bugbear of many a telephone inspector, on account of the liability to broken and poor connections. The unsightly appearance of the arm has also caused much discontent, and although manufacturers have at various times endeavored to substitute novelties in nickel-plated designs, they have always, it is said, been compelled to return to the original type, as the slight advantage in appearance was lost in the general efficiency.

The Schmidt & Bruckner Electric Co. have constructed and



SCHMIDT TELEPHONE ARM.

applied for a patent on an arm that they think meets these objections, and combines perfection in electrical and mechanical design with a handsome appearance. Two strong steel rods connect the transmitter with the base and serve as conductors for the two sides of the circuit. At the base these rods are set in a hard rubber socket and connect with springs on the inside of the socket. These springs are of phosphor bronze, V-shaped, and make rubbing contacts with the side flanges, and thereby allow for full play of the arm. A heavy finger nut of special make regulates the pressure of the springs and tension of the arm. The flanges are fastened to a block of hard rubber on the front of the coil box, and thus are insulated from each other. In the base is set a specially wound coil easily removed when repairs are necessary. The transmitter is of the American coal grain pattern, and may be removed from the arm by one screw. All the parts in fact are distinct in themselves and may each be removed separately. This they claim is a distinct advantage, as it materially cheapens and quickens repairs. The Schmidt & Bruckner Electric Co. say that the arm is already proving very popular.

"COSMOPOLITAN MAGAZINE" has offered $250 for the best essay on the most economical arrangement and construction of subways for all classes of work. The essay is not to exceed 8,000 words and is to reach the Magazine at Irvington-on-Hudson, N. Y., not later than Nov. 20.

The Telegraph Line from Cape Town to Cairo.

According to advices from South Africa, no sooner was the British flag floating over the dervish capital at Khartoum and Omdurman than Mr. Cecil Rhodes at once took steps for expediting his scheme for a trans-African line of telegraph from Cape Town to Cairo. Mr. Rhodes' lieutenant, R. D. Mohun, has already left Bombay with an expedition, bound either for Zanzibar or Mombasa. The party will take advantage of the agreement lately come to between the promoters and the Congo Free State and will construct a telegraph line from Lake Tanganyika to Stanley Falls, on the Upper Congo, the work being carried out under the commission of the State. W. Cavendish, the well known explorer, is already carrying the line northward, through the extreme northern territory of the Chartered Company, and it is confidently expected that he will form a connection with the Mohun line within the next two years. By that time the Tanganyika line will have reached Stanley Falls, and Cape Town will be in telegraphic communication with the chief town on the Upper Congo, or, in other words, half the length of the line which is to connect Cape Town with Cairo will be complete. On the other hand, advices from Alexandria are that the line is being pushed southward as fast as possible. The Sirdar kept up complete communication between the front and Cairo, and now the news comes that the line is being carried toward Fashoda from Khartoum at the rate of four miles a day.

HAVANA, ILL. The Havana Telephone Company has been formed with a capital stock of $5,000, no bonds. E. T. Munger is president and manager; O. D. Covington, secretary and C. P. King, treasurer. The American Electric Telephone Company's system has been put in, with a board of 100 drops, 70 subscribers, 30 miles of circuit B. B. wire, and 27 miles of toll line. The rates are $16 and $22 per year and 20 cents per toll message.

SOCIETY & CLUB NOTES

MR. EDWARD H. JOHNSON is to give an address on Thursday, Nov. 17, at 8 p. m., at the College of the City of New York, Twenty-third street and Lexington avenue, on the interesting and important subject of "Surface Contact Railways." The topic is timely and the speaker is a master of it. The address will be illustrated with lantern slides.

MUNICIPAL AFFAIRS

Detroit Is a Poor Example.

Considering how the municipal plant at Detroit was heralded as a marvel of efficiency and economy up to the time of its last report, which showed that it was not making lights any cheaper than service companies, the following comment by Superintendent Cook, of the Toledo Water Works, is positively comic: "Detroit has one of the most expensive plants in the country, for the reason that its location and original cost of construction are above the average of other cities. Again, the plant was not constructed for economical operation. The towers used in that city require more power than ordinary lights, and the equipment of the plant is in no wise up to date. I remember that when I looked over the plant there were running one incandescent machine, with two boilers. I asked why one of them was not shut down, and was informed that it would have to cool off, which would probably be as expensive as running it. Then the fixed charges of the plant are higher than they would be in any other city, for the simple reason that Detroit is paying more interest than any other city would." Mr. Cook is advocating a Toledo municipal plant, about which somebody may say the same hard things if he should happen to get it going.

Digitized by Google

TWENTIETH TRIENNIAL EXHIBITION OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, BOSTON, OCTOBER 10 TO DECEMBER 3, 1898.—IV.

Some More Miscellaneous Exhibits.

U. S. ELECTRICAL SUPPLY CO., 141 East 25th street, New York.—This company have several exhibits. Their acetylene gas generator (in exhibition hall) is attracting a great deal of attention. The Cox thermo-electric generator, exhibited in the same section, is intended to take the place of all kinds of electric batteries, a very small gas jet being used to produce the current. Nothing could be more simple in its operation, and it is being used largely for ringing bells, running fans, etc. Their wireless telegraphy and X-ray exhibits form two of the principal attractions of the Fair, and were fully described in previous issues. Their manner of exploding submarine torpedoes by means of electric waves, was also fully illustrated, and each of their exhibits is in charge of a courteous attendant, who is ever ready to thoroughly explain the apparatus to visitors, whether interested from mere curiosity or from a commercial standpoint. Mr. W. J. Clarke himself is also on the scene and deserves great credit for bringing his apparatus so prominently before the New England public.

NEW ENGLAND PUMP CO., 43 Milk street, Boston.—This company display a variety of pumps, and the Olin gas and gasoline engines, for which they are the New England business managers. For hand use they have the Geiger pump, which is new in this part of the country. It is of the oscillating nature, and does away with the old back-breaking style of up and down motion, and works very easily, yet delivering large quantities of water, as well as forcing it to a great height.

DEANE STEAM PUMP COMPANY, Holyoke, Mass., are making a very extensive exhibit of pumps for various purposes and of a great variety of types. Among these are a "sinker" pump for boiler feeding, saving considerable floor space. It pumps 65 gallons per minute and is built of sufficient strength to be able to pump against any commercial boiler pressure. It occupies a floor space measuring 23x27 feet, is 9 feet high, and has outside-packed, double-acting pistons. They also show a combined receiver and pump on one base for taking drips of condensation and returning them under high pressure; a duplex double-acting steam pump for high pressure boiler feeding; a combined jet condenser and pump, and many other types.

THE TONKIN INTERNALLY FIRED WATER TUBE BOILER is installed not only as a boiler exhibit, but also to furnish 150 h. p. under high pressure (125 pounds) for engine and motor exhibitors, and it is claimed to be one of the greatest advances in the progress of steam power that has been made since the invention of the Corliss engine. The boiler is equipped with the best-known appliances; namely, the Continental shaking grates, the Ashton pop safety valve, the Ashton steam gauge and water column, and the Wainwright heater. Also, for the purpose of making tests, a Fairbanks wheelbarrow scale and a Hersey water meter have been selected for their well-known reliability. The boiler is covered with the Asbestos Paper Co.'s patent air-cell pipe covering, which prevents the radiation of heat in the boiler room, and gives greater efficiency to the boiler. It is the intention of the agent, Mr. Wm. H. Bailey, 15 Federal street, Boston, to have the most thorough scientific tests of the performance of the boiler made before and during the exhibition.

NORTON EMERY WHEEL CO., Worcester, Mass., are exhibiting a full line of their manufacture and attracting a large number of interested visitors to their booth. The company manufacture all kinds of emery and corundum wheels, India oil stones, also a full line of grinding machinery. Norton's Grade List and other literature will be cheerfully mailed to any address upon application.

CONTINENTAL GRATE CO., 85 Devonshire street, Boston.—The Continental shaking grate has been extensively used during the last eight years, and is claimed to have proved its superiority, being simple, durable and easily operated. It works satisfactorily with any sort of fuel, saves opening the furnace door to slice the fire, and is free from the obstruction to movement incident to many other shaking grates. Over 500 of these grates are in use in Boston and vicinity. Two of them, each 7½ feet wide by 7 feet long, have been used for several years by the Doliber-Goodale Company, manufacturers of "Mellin's Food," and the cost of repairs has been trifling. The Continental grate is in use in many paper mills, water works, and electric light and power plants, where the requirements are specially severe, and where it has given excellent satisfaction.

INCANDESCENT ELECTRIC LIGHT MANIPULATOR AND CLEANER CO., Hyde Park, Mass.—As its name indicates, this company manufactures a device for the safe and convenient handling of electric light bulbs. Its suggestiveness falls far short, however, of the actual value of the device, which is almost human in its operation, reaching high into the loftiest space, grasping the lamp with a firm, yet "velvet" hand, deftly unscrewing and removing it for cleaning or renewal, and returning it securely to its place. The operator—any child can handle it—stands on the ground or floor, no stepladders or other climbing device being required. The remarkable thing about this manipulator is its unerring accuracy in finding the thread, whatever may be the angle at which it is held. For theatres, public halls, street lamps, show windows, etc., it is invaluable. It is in use by a large number of companies, theatres, etc., in this country and abroad, and wherever used has given entire satisfaction. Mr. Joseph J. Dunn, the inventor and manager, will be pleased to furnish any information about this labor-saving device and should be addressed to 175 Huntington avenue.

THE FITCHBURG STEAM ENGINE CO., Fitchburg, Mass,. have a space 30 feet long by 18 feet wide, in which they make a fine display of horizontal steam engines. Two of their engines are shown in operation driving a number of large General Electric generators. A direct connected unit is also shown, runs noiselessly and is very attractive in appearance. The numerous advantages of this well-known engine are pointed out by Mr. Fred. Fosdick.

SPRING PARK LABORATORY, 38 Spring Park avenue, Jamaica Plain, Mass.—The products of this laboratory are here shown for the first time to the public, and the Kinraide induction coils, transformers and high potential ozone generators are attracting a great deal of attention. A number of negatives of very curious spark effects are exhibited and their study may lead to some very interesting conclusions. In this same space Messrs. Kirmayer & Oelling, 17 Blomfield street, Boston, Mass., are exhibiting their X-ray supplies, such as Crookes tubes, static machines, fluoroscopes, Ruhmkorff coils and chemicals.

THE DIESEL MOTOR CO., OF AMERICA, 11 Broadway, New York, are exhibiting the same motor which was running at the electrical show in New York last May, and which was fully illustrated and described in our issues of February 17 and May 26, 1898. The only difference is that in New York it was direct connected to a C & C generator, while at this Fair it is belted to countershafting, from which a number of exhibits receive their power. The engine is run by crude petroleum and is said to give an efficiency considerably higher than a steam engine does.

THE STANDARD THERMOMETER AND ELECTRIC CO., Peabody, Mass., have a very tastefully arranged booth in the main hall, which is practically filled with the numerous types of the Upton enclosed arc lamps manufactured by this company. All lamps are in operation, some with their covers removed, showing the method of feeding, etc. The lamps were described and their advantages enumerated in our issues of March 3-31, 1898.

JORDAN, MARSH & CO., Washington street, Boston, who are a local headquarters for electrical toys, exhibit a miniature electric railroad, equipped with electric cars. To operate the road, it is only necessary to attach the connecting cord to an incandescent light circuit and the cars can then be run at the pleasure of the operator.

SAMSON CORDAGE WORKS, 115 Congress street, Boston.—An interesting exhibit is that of the Samson Cordage Works, who display their manufacture of braided cord in a variety of sizes, materials and colors. They exhibit railroad cords and signal cords, curtain cords, mason's lines, chalk lines, clothes lines, etc. Their exhibit is surrounded by a novel railing, consisting of some of their large-sized cord stretched between posts.

OTHER EXHIBITORS WERE THE FOLLOWING, whose

Digitized by Google

exhibits helped to make this Fair of unusual interest to all interested in electricity and its numerous applications: Edwin Read, 177 Tremont street, Boston, an exhibition of kinetoscopes with a variety of new and interesting views; John D. Reed, 82 Maywood street, Boston, a new system of rails of special interest to railroad men; Geo. H. Richter & Co., 92 Franklin street, Boston, electric duplicating machine (rotary neostyle), filing cabinets and office furnishings; Niles Tool Works Co., 65 Oliver street, Boston, a variety of machine tools in operation; John A. Roebling's Sons Co., Trenton, N. J., a sample board of electrical wires and cables presented to the Massachusetts Charitable Mechanic Association; Rubber Tire Wheel Co., 92 Beverly street, Boston, rubber tired wheels; Morse Twist Drill and Machine Co., New Bedford, Mass., an exhibit of arbors, chucks, counterbores, dies, drills and machinists' tools in general; James H. Roberts & Co., 137 Portland street, Boston, an exhibit of steam engines and boilers, shaftings, hangers, wood and iron pulleys, friction clutches, automatic speed regulators, etc.; Rochester Automatic Lubricator Co., Edwin Allen, New England agent, 185 Franklin street, Boston, a positive feed mechanical lubricator for lubricating the cylinders and valves of engines and pumps, being a force pump, and receiving its motive force from the engine to which it is attached; J. H. Wilday, 23 Duane street, New York, a demonstration of the art of engraving by electricity; Eaton Electric Motor Carriage Co., Boston, Mass., electric motor carriage; William O. Webber, 432 Exchange Building, Boston, a new type of vertical boiler possessing unique features; Frank Andrews, 111 Liberty street, New York, representing the Ashcroft Manufacturing Co., the Consolidated Safety Valve Co., the Hayden & Derby Manufacturing Co.; Lombard Water Wheel Governor Co., 61 Hampshire street, Roxbury, the Lombard water wheel governor in operation; Clark & Mills, 40 State street, Boston, electric dental instruments of their own manufacture, including all kinds of electro-therapeutic apparatus.

LEGAL NOTES

Liability for Jerking of Trolley Car.

In John Hassen's suit against the Nassau Electric Railway Company for damages for personal injuries, it appeared that he was riding on an open car with a running board on the side, upon which he stood, because of the crowd of nearly ninety persons on the car. Passengers were standing between the seats, but some such standing room remained. Hassen paid his fare when demanded, and the conductor objected neither to his position nor that of other passengers, who stopped on the running board, nor requested him to get inside. It was shown to be customary for persons to ride on these running boards when the cars were crowded. The car was running from six to eight miles an hour, when it was given a sudden violent jerk, which broke plaintiff's hold on the car stanchion and throwing him against a neighboring trolley pole, injured him on the head. The Second Appellate Division has affirmed judgment secured by plaintiff on the trial. In reference to the company's claim that plaintiff was guilty of contributory negligence in riding on the board when he could have found standing room between the seats, Justice Hatch, who gave the opinion, said: "It is well known that the space between these seats when they are occupied is quite narrow; with small people sitting, the space in front might be occupied with more or less inconvenience, but with large persons seated, it may be a matter of extreme difficulty to stand, and sometimes an impossibility. In all cases it is a place of discomfort, and disagreeable to those both sitting and standing. The cars to Coney Island are at most times crowded within and without, in all available space. The defendant expects this and collects fares from every one. Under such circumstances we think the question of negligence becomes one of fact to be determined by the jury, having regard to particular conditions. The defendant was bound to know that the application of motive power in such manner as to cause the car to give a violent jerk was extremely hazardous, in view of the position of many of the passengers on the car, and might result in injury; therefore, the jury was authorized to say that it was a negligent act."

Revenue Stamps on Express Receipts.

Judge Lacombe of the U. S. Circuit Court, New York, has ruled that the law does not require express companies to pay the one cent stamp tax on express receipts, as contended by merchants and others. The case is now being prepared for appeal to the U. S. Supreme Court, where it is likely to come up in March.

Marks Enclosed Arc Lamps Method Patent Sustained.

The injunction issued Oct. 18, 1898, by Judge Coxe perpetually restraining the Washington Mills Company, New York, from infringing the Marks-Ransom enclosed arc method patent, and the permanent injunction issued Nov. 5, 1898, by Judge Lacombe against the Electric Construction and Supply Company, manufacturers of the Kinsman lamp, have been held to apply to the enclosed arc lamps manufactured and sold by the General Electric Company. Following the order of the court forty General Electric enclosed arc lamps have just been removed from the factory of the Washington Company, Lawrence, Mass., and other lamps of the same type, but licensed under the Marks patents by the Marks Enclosed Arc Light Company, are now being substituted for those lamps.

Following are the claims of the Marks & Ransom patent, No. 520,996, June 5, 1894, upon which the action was based, and were sustained by the court:

1. The method of operating an arc lamp on constant potential circuits, which consists in confining the arc within an enclosure, restricting practically all the drop of potential in the arc circuit to the arc and continuously maintaining said drop at a point which prevents an excessive flow of current.

2. The method of operating an arc lamp, consisting in confining the arc with an enclosure from which the air is excluded, or which it has difficult access and maintaining a long arc to produce a large than normal drop of potential, whereby an arc light of normal intensity may be maintained by an amperage lower than normal.

LITERATURE

LECTURE NOTES ON A THEORY OF ELECTRICAL MEASUREMENTS. By Prof. William A. Anthony. New York: John Wiley & Sons, 1898. 4¾x7½ inches; 90 pages; 14 illustrations. Cloth. Price $1.

These lecture notes are prepared for the third year classes of the Cooper Union Night School of Science, and cover the topics treated in lectures which are designed to teach the fundamental principles of all electrical measurements rather than to describe in detail the methods employed in particular cases. The author has therefore given particular attention to definitions, and the relations of electrical quantities are discussed at considerable length. Though small in compass, the work covers the ground in a most admirable manner which leaves nothing to be desired in the way of clearness combined with accuracy. We are glad to note that Prof. Anthony has given a number of applications of fundamental principles to practical electrical work such, for instance, as the application of the laws covering heating effects to the construction of incandescent lamp filaments and to the distribution of energy in the arc lamp, as well as other examples of a like nature.

THE NATIONAL CAPITOL. The investigation into the recent serious explosion in the National Capitol building at Washington, in which the United States Supreme Court was badly wrecked and its archives damaged, shows that it was due to heavy leakage of gas. The officials will insist that the entire building be provided with electric light.

Digitized by Google

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued November 1, 1898.

Alarms and Signals:—

GRADE CROSSING SIGNALS FOR RAILWAYS. H. McL. Abernethy, Elmira, N. Y., 613,549. Filed Sept. 9, 1897. Employs a track instrument comprising a rotary circuit closer adapted to be actuated by a passing locomotive or train.

BLOCK SIGNALING APPARATUS. T. T. Fogel, Allentown, Pa., 613,567. Filed Dec. 6, 1897. Details of construction.

COMBINED LEAK AND FIRE ALARM. H. I. Lurye, New York, 613,636. Filed Nov. 19, 1897. Comprises a pipe provided with a sprinkler and with longitudinal ribs and a hanger and transverse arms combined with a lever fulcrumed between the ribs, a stop for the lever carried by the hanger, and a circuit closer connected to the lever and to a conductor carrier, the lever having a receiver placed in proximity to the sprinkler.

Conductors, Conduits and Insulators:—

INSULATOR FOR INCANDESCENT ELECTRIC LAMPS. C. W. Brown, Boston, Mass., 613,647. Filed Dec. 15, 1897. A reversible insulator formed of non-conducting material internally threaded, having about centrally a thickened peripheral ring and at either side thinner end portions projecting longitudinally from and of less diameter than the ring.

Lamps and Appurtenances:—

INCANDESCENT ELECTRIC LAMP HOLDER. G. W. Cook, Jr., Bloomfield, N. J., 613,248. Filed Nov. 5, 1897. Employs a wire frame, attached to the lamp bulb and socket, co-operating with sliding means secured to the lamp shade.

MECHANISM FOR SUPPORTING ELECTRIC ARC LAMPS. W. A. McCallum, Avondale, Ohio, 513,293. Filed Nov. 18, 1895. Embodies a mast-arm head carrying a contact holder, and contact carriage, the lamp being suspended from the carriage, the mast-arm being hollow, and the carriage moving therein.

Miscellaneous:—

ELECTRIC VEHICLE. K. Knudson, Chicago, Ill., 613,420. Filed June 18, 1897. Comprises an electric motor, a hollow shaft upon which its rotating element is mounted, a pair of shafts journaled within the hollow shaft and geared respectively with the opposite wheels of the vehicle, bevel gears mounted on the opposed ends of the shafts, a pair of pinions engaging therewith and mounted on the frame secured to and rotating with the hollow shaft.

ELECTRIC ROTARY CUTTER. F. Gardiner, Chicago, Ill., 613,367. Filed March 19, 1897. Details of construction.

Railways and Appliances:—

YOKE FOR RAILWAY CONDUITS. F. S. Pearson, Boston, Mass., 613,301. Filed Nov. 4, 1897. Is adapted to support the slot-rails and wheel-bearing rails, having a hollow central portion and detachable manhole-curbs flush with the surface of the roadway.

SUSPENSION FOR ELECTRIC RAILWAY MOTORS. W. Cooper, Cincinnati, Ohio, 613,357. Filed Aug. 16, 1898. Embodies a motor sleeved to the driven axle in combination with a pair of supports therefor engaging the sides of the motor at points located between the driver axle and the centre of gravity of the motor.

ELECTRIC CAR LIGHTING. W. Biddle, New York, 613,406. Filed May 14, 1894. One portion of the field is placed in a shunt between the brushes and the other and oppositely-wound portion in series in the main circuit that contains the translating devices and the armature in multiple arc, so that the potential of current will be nearly uniform regardless of the speed of the armature.

ELECTRIC RAILROAD. C. L. Kemery, Pittsburg, Pa., 613,418. Filed Jan. 12, 1898. Consists of a track with an intermediate rail acting as a conduit for the current wires, plates of suitable conducting material insulated from adjacent ones arranged with the conduit and strips of soft iron connected to the current wires and plates.

ELECTRIC RAILWAY SYSTEM. L. E. Walkins, Springfield, Mass., 613,433. Filed Nov. 18, 1897. Surface contact system.

ELECTRIC RAILWAY SYSTEM. L. E. Walkins, Springfield, Mass., 613,612. Filed May 20, 1898. A third-rail system utilizing alternating currents.

Switches, Cut-Outs Rheostats, Etc.:—

EMERGENCY FUSIBLE CUT-OUT FOR ELECTRIC CIRCUITS. C. H. Long, Louisville, Ky., 613,286. Filed July 10, 1897. Details of construction.

ELECTRICAL FUSE WIRE HOLDER. W. D. Packard, Warren, O., 613,594. Filed Sept. 29, 1897. Comprises an insulator having terminals, a translucent casing projected outwardly from a movable fuse-wire holder located within the casing, being in electrical contact with the terminals, and a yielding bearing for the holder.

Telegraphs:—

PRINTING TELEGRAPH. A. Wirsching, New York, 613,348. Filed May 10, 1897. Details of construction.

Telephones:—

TELEPHONE BOX OR CABINET. I. Sparks, Santa Fe, Mexico, 613,533. Filed March 22, 1898. Provides a cabinet with an enclosure having a partition for separating the battery receptacle from the closure holding the call mechanism and the electromagnets, the fronts of the upper and lower closures in the box being adapted to be opened and the top of the box being closed by a movable writing board.

Classified Digest of U. S. Electrical Patents Issued Nov. 8, 1898.

Alarms and Signals:—

INDICATOR SIGNAL. Parnell Rabbidge, Sydney, New South Wales, 613,778. Filed Feb. 1, 1897. Comprises an ordinary horseshoe permanent magnet the poles of which are provided with transverse pieces of soft iron.

ALARM. Charles A. Deal, Chicago, Ill., 613,877. Filed July 29, 1897. A burglar alarm system for banking houses comprising a series of levers arranged vertically below the counter, the levers being pivoted each at one end and carrying a shoe at the other, a metallic contact spring, located in the path of the shoe, and plates also underneath the counter, the plates and levers being connected to wires extending from a battery and bell.

Batteries, Primary:—

PRIMARY BATTERY. Carl Koenig, Berlin, Germany, 614,012. Filed Feb. 16, 1898. Consists in arranging the alternate elements of the battery in a concentric cylindrical form, divided between each pair by a concentric insulated pot of glass, and so arranging the number of these elements to produce the required voltage and coupling them by the conducting strips in series or parallel as required.

Conductors, Conduits and Insulators:—

CONNECTOR. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, New York, 613,663. Filed Aug. 5, 1898. Comprises counterpart terminals having slots registering with screws, and depressions in which the screw-heads may rest to secure the parts together.

Distribution:—

GENERATING AND DISTRIBUTING ELECTRIC ENERGY. Chas. M. Green, Cleveland, O., assignor to the General Electric Company, New York, 613,880. Filed April 18, 1896. A method of connecting a constant-current dynamo having two or more armature circuits, consisting in arranging the connections so that one or more of the armature circuits of the dynamo shall be interposed between the lamp circuits and the voltage kept within safe working limits.

GENERATING AND DISTRIBUTING ELECTRIC ENERGY. Chas. M. Green, Cleveland, O., assignor to the General Electric Company, New York, 613,881. Filed Dec. 23, 1896. A dynamo electric machine having an armature with its coils divided into two or more successive sets, light insulation between the individual coils of each set and heavier insulation between the sets of coils.

GENERATING AND DISTRIBUTING ELECTRIC ENERGY. Chas. M. Green, Cleveland, O., assignor to the General Electric Company, New York, 613,882. Filed Dec. 23, 1896. Similar to 613,880.

Dynamos and Motors:—

BRUSH HOLDER. Albert E. Doman, Elbridge, N. Y., assignor to the Elbridge Electrical Mfg. Company, New York, 613,669. Filed Feb. 4, 1898. Consists of a support, combined with a brush clamp secured thereto by a ball-and-socket joint.

CONTROLLING DEVICE FOR ELECTRIC MOTORS. Frank J. Russell, New York, N. Y., assignor of one-half to Horace See, New York, N. Y., 613,869. Filed May 25, 1898. Details of construction.

DYNAMO AND ELECTRIC MOTOR FOR DRIVING VEHICLES. John Vaughan Sherrin, Ramsgate, England, assignor to the Britannia Motor Carriage Company, London, England, 613,894. Filed Aug. 17, 1896. The armature and the field magnets rotate in opposite directions, at the same or at different speeds, while both hang on and actuate the dynamo driving shaft or the motor shaft, and by means of suitable gearing the speed of rotation of the shaft is suited to the requirements of the dynamo or the machine to be driven.

BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES. George L. Pratt, Atlanta, Ga., 614,025. Filed June 2, 1898. Means operating automatically, when the current is cut in, to cause the brushes to move into engagement with the commutator, and means operating automatically, when the current is cut out, to move the brushes out of engagement with the commutator.

Lamps and Appurtenances:—

CAP FOR ENCLOSED ARC LAMPS. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company, New York, 613,658. Filed April 23, 1898. Consists of a flange which rests on the top of the cylinder, a second flange situated below the first, a hub connecting the two flanges, and acting with the flanges to form a chamber, a carbon opening in the hub, and a plurality of small chambers also, formed in the hub, which surround and communicate with the carbon opening.

Measurement:

INSTRUMENT FOR MEASURING ELECTRIC CURRENTS. Earl C. Eldredge, Springfield, Mass., 613,899. Filed June 20, 1898. Pocket battery gauge.

Miscellaneous:—

ELECTRIC RACE TIMING APPARATUS. John Irving McDonald, St. Joseph, Mo., 613,705. Filed Jan. 4, 1897. Consists of a dial, a main hand and an auxiliary hand, both co-operating with the dial, mechanism for actuating the hands, electrical devices for temporarily arresting the auxiliary hand, and separate electrical devices for stopping the main hand, at will.

BICYCLE. Mathew Joseph Steffens, Chicago, Ill., assignor of one-half to John K. Robinson, Chicago, Ill., 613,732. Filed Sept. 29, 1897. Comprises a pulley having a periphery rounded in cross-section, means for rotating the pulley, a driving wheel, having a periphery rounded in cross-section, and a belt cup-shaped in cross-section running around the pulley and around the periphery of the driving wheel and between the wheel and the ground, to insure leverage.

ELECTRIC-CIRCUIT CONTROLLER. Nikola Tesla, New York, N. Y., 613,,735. Filed April 19, 1898. Details of construction.

METHOD OF AND APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS OR VEHICLES. Nikola Tesla, New York, N. Y., 613,809. Filed July 1, 1898. See page 489.

PHOSPHORESCENT ELECTRIC LIGHTING. Daniel McF. Moore, York, N. Y., 613,864. Filed Dec. 17, 1896. Rotary break; details of construction.

MARINE GOVERNOR. John T. Austin, Detroit, Mich., 613,875. Filed Feb. 26, 1898. Details of construction.

ELECTRIC LIGHTING SYSTEM FOR VEHICLES. Rufus N. Chamberlain and Albert S. Hubbard, Belleville, N. J., 613,918. Filed Feb. 17, 1898. Embodies a sectional construction of the generator allowing of its attachment to the car axle.

STATION INDICATOR. James E. Carter, Bridgeport, Cal., assignor of one-half to Joe A. Brown, Bridgeport, Cal., 613,967. Filed Oct. 2, 1897. Details of construction.

APPARATUS FOR FREEING, LIGHTING AND EXTINGUISHING GAS BURNERS. Paul Guyenot, Aix-les-Bains, France, 613,990. Filed Dec. 18, 1897. Comprises a burner-tube, a lighting-tube, and a platinum wire, with a guard forming a chamber around the wire closed except at the top to keep the wire from burning in contact with the air.

AERIAL ROPEWAY. Joseph Walwyn White and Herbert White, of Widnes, England, 614,046. Filed July 8, 1898. A system of electrical traction comprising a plurality of sectional lines of carrying-ropes, one line being the conductor and the other the return line.

Digitized by Google

Railways and Appliances:—

ELECTRIC RAILWAY.— James F. McLaughlin, Philadelphia, Pa., 613,708. Filed May 9, 1896. A surface contact system employing an exposed circuit terminal consisting of a plug in the roadbed, composed of a body portion, a removable contact face, and locking mechanism for holding the latter against accidental removal.

TROLLEY POLE GUIDE ROPE. Samuel R. Parks, Central Falls, R. I., 613,713. Filed Aug. 4, 1897. Consists of a tubular rope with funnel attached combined with the trolley wheel and pole of trolley cars.

MECHANISM FOR HOLDING TROLLEYS TO THEIR WIRES. William R. Weaver, Covington, Ky., assignor of two-thirds to George L. Weaver and Harry D. Weaver, Covington, Ky., and James C. Brown, of Franklin, O., 613,744. Filed Oct. 9, 1897. Details of construction.

ELECTRIC RAILWAY. William Milton Brown, Johnstown, Pa., assignor to the Johnson Co., of Lorain, O., 613,794. Filed Jan. 22, 1898. Comprises a current-conveying switch having a normal position in which it is connected with one side of the circuit and a temporary position in which it is connected with the opposite side of the circuit and with the conductor section.

Regulation:—

ELECTRIC REGULATOR. William H. Chapman, Portland, Me., assignor to the Belknap Motor Company, Portland, Me., 613,853. Filed March 24, 1898. Comprises a solenoid having a differential winding mounted on a tube and having its magnetic core fitted as a piston to the cylinder, a passageway leading from one end to the other of the cylinder, and means for closing the passageway to a greater or less degree.

Switches, Cut-Outs, Etc.:—

ELECTRIC SWITCH. Frederick A. La Roche, New York, N. Y., 613,688. Filed Dec. 28, 1897. A form of pivot joint for knife switches.

MARRIED

Danforth—Johns.

Mr. George C. Danforth, manager of the Decatur, Ill., Gas & Electric Light Co., and Miss Laura A. Johns, youngest daughter of Dr. H. C. Johns, were married at the home of the bride's parents on the evening of Nov. 2.

Splitdorf—Urban.

The marriage occurred on Nov. 8 of Emma, daughter of Mrs. Minna Urban, to Mr. Chas. F. Splitdorf, of New York City. The bridegroom is well known in electrical circles as member of the Splitdorf Co., makers of fine insulated wire, special electromagnets, X-ray coils and other articles, and the firm is one of long reputation in the industry. He and his bride have many friends in Europe.

PERSONAL

MR. C. LAMBDIN, manager of the Jamaica Telephone Co., Kingston, Jamaica, has been on a visit to this country to see about changing over the system from grounded to metallic. He has about 400 subscribers, charging $2.50 per month, business, and $2, residence, within a three-quarter-mile radius. He will string new cables. Mr. Lambdin is an old Southern Bell manager, and is one of the many Americans who have gone out to Yankeeize the West Indies and who are succeeding in their work.

MR. JOHN McGHIE, head of the publicity department of the General Electric Co., has a very interesting and informational article in "Cassier's Magazine" for November on electricity in mining, the article being also well illustrated.

HON. G. C. SIMS, who volunteered for the war and served as one of the chief engineering officers on the useful repair ship "Vulcan," is now home again in excellent health and trained down to fighting weight. He has fought for his country in about as effective a way as any man could, and should feel very proud.

MR. W. J. CLARK, manager of the Railway Department of the General Electric Company, has had the sad duty devolved upon him of finishing for the U. S. Government the report of Col. Waring, who died last month in New York City of yellow fever. Col. Waring visited Cuba to grapple with the sanitary problems there. On his way back, Mr. Clark, who has also been in confidential relations with the authorities and is bringing out a book on Cuba, was Col. Waring's companion and practically his nurse. He thus became familiar with his plans and data and has been requested by the Secreatry of War to prepare the Waring documents for use.

MR. W. A. EDDY has been flying his kites in the vicinity of the Statue of Liberty, New York Harbor, and finds the air highly charged there. He had expected just the contrary.

MR. J. G. WHITE, of the electrical engineering firm of J. G. White Co., left recently for a brief European trip, including England, Germany, etc.

MR. LEWIS SEARING has been elected vice-president and general manager of the Denver Engineering Works, manufacturers of steam and electric mining machinery. Mr. Searing is a graduate from Stevens' Institute of Technology in 1888, and is a member of the A. I. E. E. and of the A. S. M. E.

MR. W. LINDSAY, formerly with the Frank M. Pierce Engineering Company, of New York City, has joined the local selling staff of the C & C Electric Company, succeeding Mr. C. H. Kirkland, who has resigned.

OBITUARY

Horace B. Miller.

We regret to note the death of Mr. H. B. Miller, one of the two founders and original proprietors of that sterling mechanical paper, the "American Machinist." He was born in Philadelphia in 1839, served under Farragut in the civil war, became connected with journalism at Pittsburg, Pa., and with Jackson Bailey started the "Machinist" in 1877. He witnessed the paper's growing influence and prosperity under his own fostering care until 1894, and disposed of his interests in it in 1897. He died on Oct. 25, at Napa, Cal., of heart failure. He was a member of the Press Club and also of the American Society of Mechanical Engineers, whose preliminary meetings were held in his office. The interests of technical journalism were always very close to him, and the subject was one he had thoroughly mastered. We may testify to the pleasure enjoyed in social intercourse with him and the valuable data freely furnished from his long and ripe experience.

Latimer Clark.

As we go to press we receive the sad news of the death of Mr. Latimer Clark, C. E., F. R. S., which took place quite suddenly at his residence at Twickenham, England, on Sunday morning, Oct. 30. This announcement will be read with sorrow by a wide circle of our readers, who have learned to regard this well known engineer as one of the greatest contributors to modern science and to the art of electrical measurements. Mr. Clark was in his seventy-seventh year at the time of his death and his active career will be reviewed in our next issue.

A. de Meritens.

To see a deserving inventor fail of his reward is sad, but it is even more painful to record his death from suicide caused by want and misery. Few names were better known in early lighting work than that of A. de Meritens, whose work goes back to 1881 and even earlier. His system was adopted in 1881 for the Planier lighthouse in France, and is said to be employed to this day in the majority of French lighthouses, as well as in many others in various countries. Of late years M. de Meritens has been interested in the commercial exploitation of city lighting, but with ill-success, and financial embarrassment. He had been living lately in a little house at Eragny-Neuville, near Pontoise. The sheriff's officers arrived to seize his furniture and found the cottage hermetically closed. On breaking in the officers found him lying on a bed with his wife, both dead. They had poisoned themselves with a white powder, of which traces were detected in a glass. M. de Meritens was 65 years of age, and his wife 35.

MR. HARVEY S. SPENCER, secretary of the Hamburg, N. Y., Water & Electric Light Co., died of apoplexy on Nov. 3. He was fifty-eight years old, and was cashier of the Bank of Hamburg, as well as prominent in other social and business matters.

Digitized by Google

THE STOCK MARKET

A Sound Money Victory and Better Times.

Whatever else the elections last week proved, they are taken everywhere to mean a victory for sound money, the Congress that has been elected being overwhelmingly that way with Republican and Gold Democratic votes. The response of the business and financial community has been immediate, and industry in well-nigh every line has taken on new confidence and hopefulness. The situation is clearly reflected in the quotations on all the exchanges throughout the country. "Bradstreets" reports also a higher level of prices in nearly all staples, except food. Business failures for the week were 187, as compared with 273 a year ago. Railroad earnings show activity in transportation. Throughout the West general trade is reported excellent.

During the week in Wall Street, Western Union advanced 1½ net to 93¾; General Electric advanced 1¼ net to 82¾; Metropolitan Street Railway closed at 168½. In Boston, American Bell Telephone closed at 279, and West End Railroad at 88.

Copper last week reached 12.62½, New York, quite an advance. A rise in steel rail is looked for to $20.

TRADE NOTES AND NOVELTIES

Foster's "Electrical Engineer's Pocketbook."

HITHERTO it has seemed nearly impossible to gather complete and authentic data for an Electrical Engineer's Pocket Book, because of the rapid progress of the science and the resulting constant changes in the subject matter. But to-day our knowledge of the laws governing direct and alternating currents, their uses and their applications, as well as our understanding of the rules for construction of electrical machinery, has reached a point where it seems possible to collect many of these rules and to form a pocketbook covering the practical details of the subject for the use of engineers in the numberless applications of electricity. Every electrical engineer engaged in the practice of his profession has felt the need of such a work, but most engineers are too busy to be able to spend the time necessary for the collection and tabulation of the large amount of matter available.

A matter of interest in this connection is the announcement of the early publication, by the D. Van Nostrand Company, of the first distinctively American pocketbook of rules, formulæ and tables for electrical engineers, to be edited by Mr. Horatio A. Foster, member of the American Institute of Electrical Engineers, in collaboration with many eminent specialists. The editor has been connected with practical electrical engineering works since 1885, and, being of a statistical bent of mind, has been continuously collecting data during that time, which he has now assembled in the above mentioned form.

A number of books of this nature have been published abroad, but, with the exception of the ordinary laws of electricity, they contain but little data applicable to American practice. Moreover, the general application of electricity has advanced so much further in America than in any other country and along such various lines and under such different circumstances, that it would be difficult for one not engaged in actual American practice to collect and put in concise form the tables and formulæ most useful and desirable.

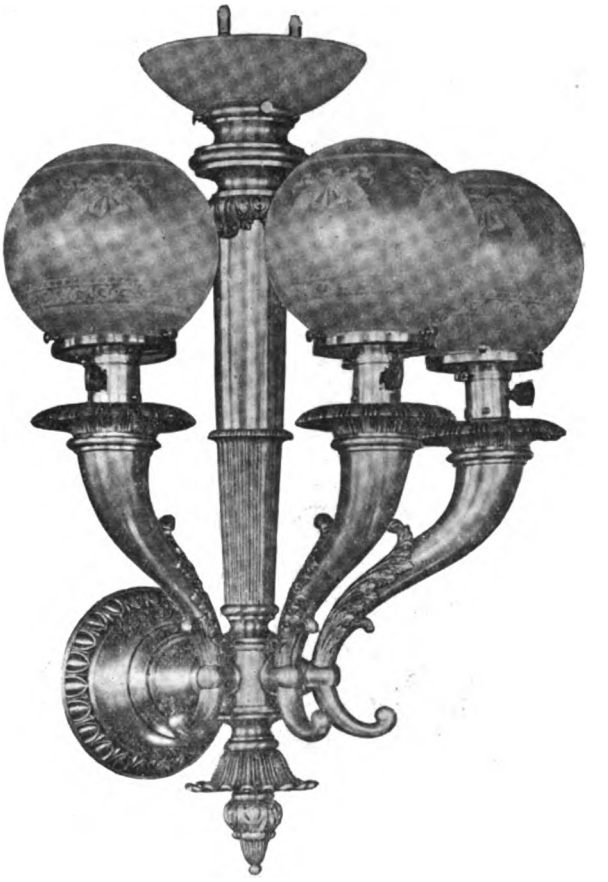
To do this it has been necessary for the writer to keep track of the current literature on the subject, to constantly collect new tables and formulæ to take the place of those which have gone out of date, or have proved of little use, and to avoid including data that will become obsolete in a very short time.

The book has been written with the idea of filling this long-felt want for an American pocketbook; the data has been selected with very considerable care, and each chapter has been edited and revised by a specialist in that particular subject. With the exception of those rules, formulæ and tables which are common to the science, and have been in use so long as to obscure their origin, the author or authority for tables and other data has been stated with the item. As the book is meant to cover American practice, but little European practice has been included, excepting, of course, where the original experimenting was done, and the laws formulated, by foreign professors and scientists, and their results universally adopted.

The book is not intended for a text-book, nor is it meant to be an encyclopedia, but simply a collection of rules, tables and formulæ, which will be found handy for reference by the practicing engineer.

Lighting Fixtures, Both Gas and Electric, as Made by the Horn and Brannen Manufacturing Company, Philadelphia, Pa.

PROBABLY no manufacturer of this line of goods has shown greater skill and ingenuity in bringing lighting fixtures to their present high state of perfection and universal adaptability than has this company. Their products embrace plain and ornamental fixtures in brass or bronze for gas or electric light and also combined fixtures. In addition to the above they design and make ornamental altar work for churches and private institutions. A specialty is made of combined fixtures on which either gas or electric lights can be burned or both at the same time. In the construction of the combined fixtures such insulating joints are employed as may be designated by the Board of Fire Underwriters of the district in which any particular fixtures are to be used. Of these joints there are eight or ten different types from which a selection can be made, and of these three or four are patents controlled by this company. The most desirable of these in the estimation of this company is known as the "flag-joint," and this is extensively employed. Insulated joints in general are devices for supporting combined chandeliers from the gas piping of the house, but are so designed by the use of an insulating medium as to prevent the wires employed for conducting the current to the lamps from being grounded, should they come in contact with the fixture.



HORN & BRANNEN COMBINATION FIXTURE.

Digitized by Google

This company cater to both the wholesale and retail trade, and their storerooms contain a very wide range of designs from which customers may select. The goods are not confined to standard designs, however, but particular attention is given to getting up original designs to suit customers, and for this purpose a number of artists skilled in this class of work are employed, and the range of output includes chandeliers and pier designs for public buildings, such as city halls and post offices, as well as ornamental work for private dwellings.

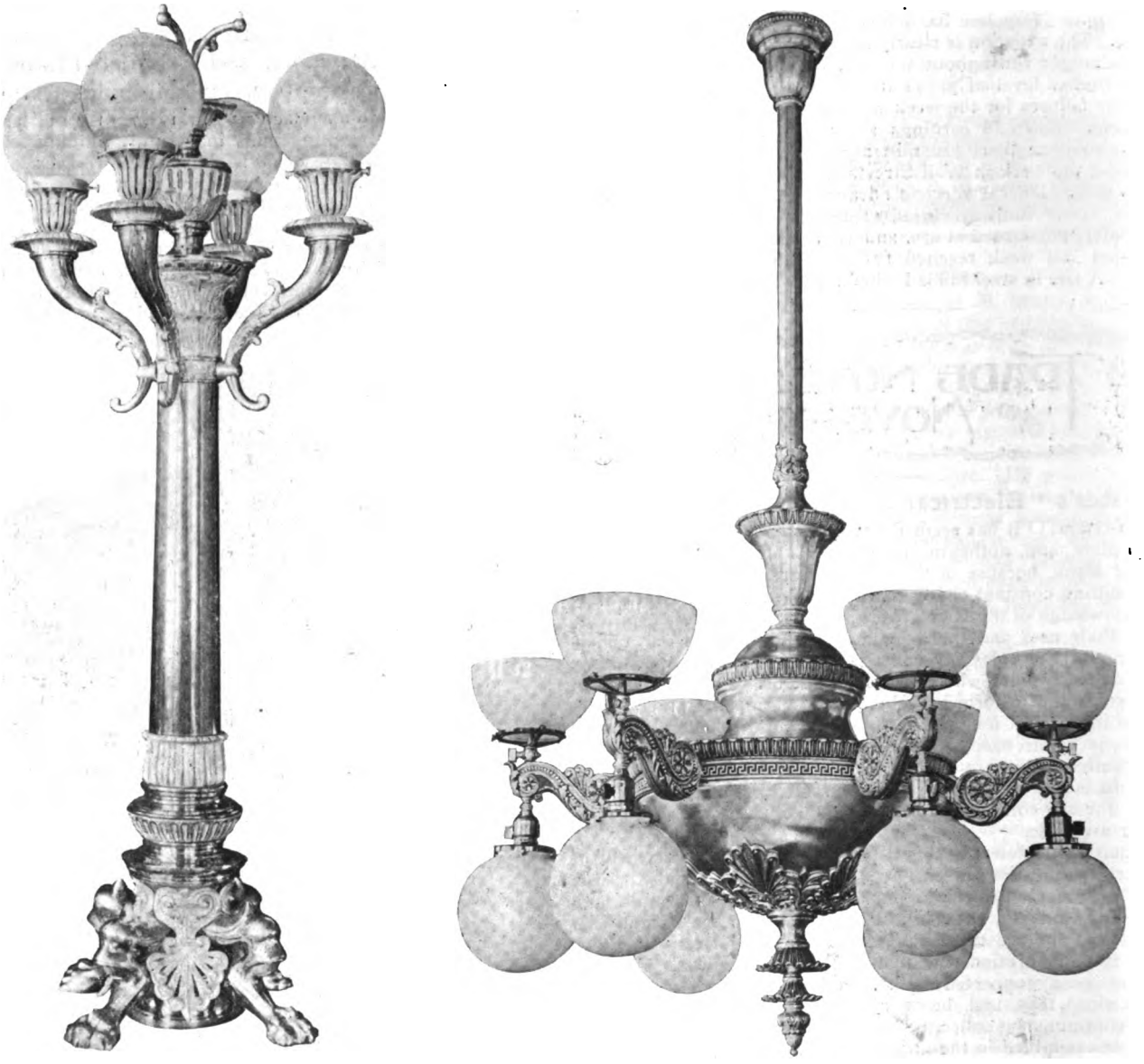
The factory and principal salesroom occupy a five-story brick building at 90 Broad street, which extends through 148 feet to Noble street. The power equipment of the factory consists of two 75 h. p. Ames engines, each direct-coupled to a Westinghouse 50 k. w. generator, which supply both power and light.

Many of the tools are operated by electric motors which were manufactured by the Electrodynamic Company, of Philadelphia. The tool equipment is very complete and of the latest designs, and include turret-headed lathes, stamping punches, and almost the entire range of metal working tools.

Fifteen or sixteen hands are employed in spinning such ornamental parts as are made from sheet metal, while the total number of hands employed averages 225. The works include an extensive brass foundry in which bronze relief figures and ornamental vine and leaf work are cast, and as auxiliary to this there is a plating and burnishing department.

The products of the firm go to all parts of this country and Mexico, and many of the South American States. Of course it is understood that lighting fixtures of this class include glass globes, reflectors and shades, and of these the company carry a wide range of designs, but these are purchased from the manufacturers of glass goods. The designs, however, are in many cases suggested by the Horn & Brannen Company, and such are manufactured exclusively for this firm.

It is interesting to note in this connection that this company have become principal defendants in the litigation relating to an insulated joint for combined fixtures, regarding which a great deal has been said in the technical papers. These suits relate to what is known as the Stieringer patents, and have been prominent in the courts of New York and Pennsylvania for years, and the contestants are now awaiting the decision of the judges of the Circuit Court of the Eastern District of Pennsylvania of a case which was tried in April last. The Horn & Brannen Company have refused to pay a license on the Stieringer patents for various reasons. In their defense it was shown that the original patent was issued to Luther Stieringer in 1882, but this was declared to be invalidated because the claims were too broad. A re-issue was obtained in 1895, but in the meantime several other patents had been obtained which were seemingly of more practical value than the original. The original design as illustrated showed the conducting wires as being led to the lamps through the pipe which conducted the gas, an impracticable arrangement, it is claimed. Hence the defendants claim that if the original patent was so broad in its claims as to defeat the purpose, then it is unfair to interpret the re-issued patent still more broadly



HORN & BRANNEN SPECIAL LIGHTING FIXTURES.

Digitized by Google

and so lay a tribute on all subsequent joints designed for this purpose. The decision in the present case will be looked forward to with interest, not only by those engaged in the manufacture of fixtures of this kind, but by all who are in any way interested in the trend of modern patent litigation.

Recent Developments in the Construction of Gold Electric Heaters.

THE Gold electric heater using the crimped or zigzag rod for supporting the resistance coils has shown such surprising efficiency in delivering the warmed air into the car body that

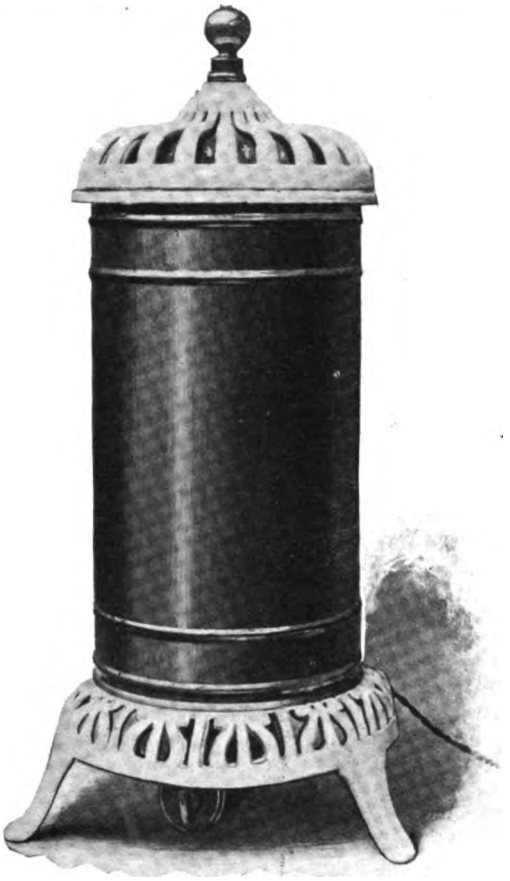


FIG. 2.—GOLD ELECTRIC HEATER FOR ROOM.

the Gold Street Car Heating Company are kept busy supplying the very large demands of the street railways and others for their improved electric heaters.

Herewith is illustrated, in Fig. 1, the latest form of Gold panel electric heater as it is now made, using a new and strikingly

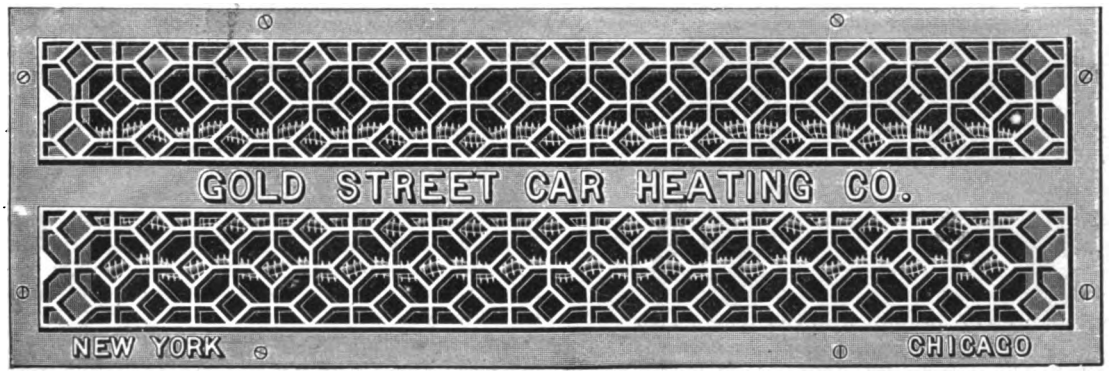


FIG. 1.—IMPROVED GOLD ELECTRIC CAR HEATER.

handsome design of front casing. Having perfected the principle of obtaining the very freest circulation of air through the resistance coils, and further having perfected all of the details of the interior arrangement of the heater regarding the graduation of the heat, the insulation, binding posts, etc., the Gold Company have seen fit to depart from the old-fashioned conventional style of heater casings, and present the one shown here. It is certainly very artistic and in keeping with the modern interior decoration of first-class street cars. Another point worth mentioning in connection with this heater, which is wired to give

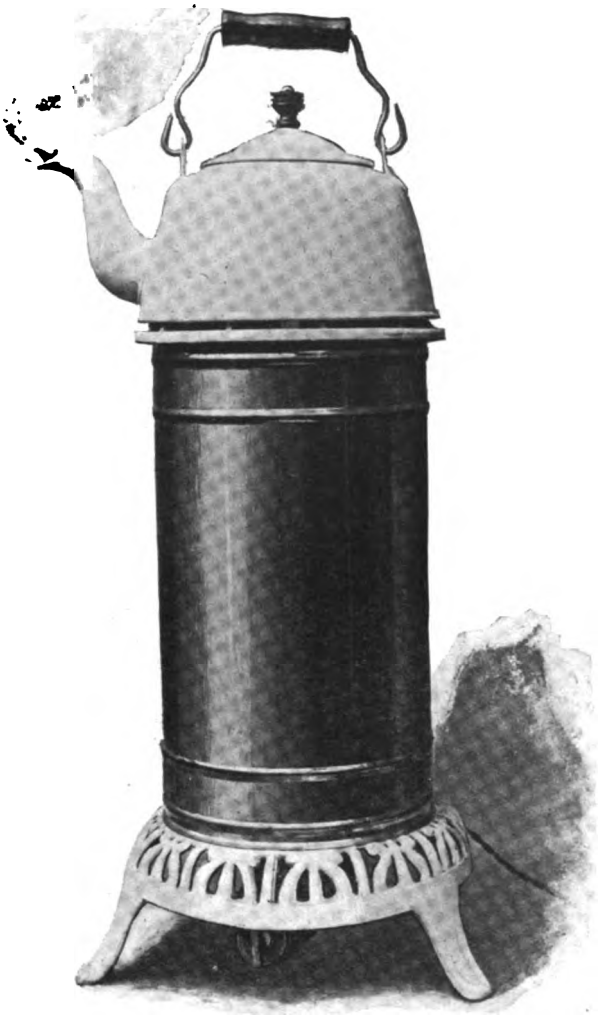


FIG. 3.—GOLD ELECTRIC STOVE.

three degrees of heat on every heater, is that the connections from heater to heater are brought out through the solid porcelain blocks which form the ends of the heaters, thus making the connections very easy and as simple as they could possibly be, and doing away also with the small porcelain bushings which have given so much trouble by breaking in casings of other types.

This heater embodies all of the improvements that the Gold Company have made in their device, and it is one that challenges

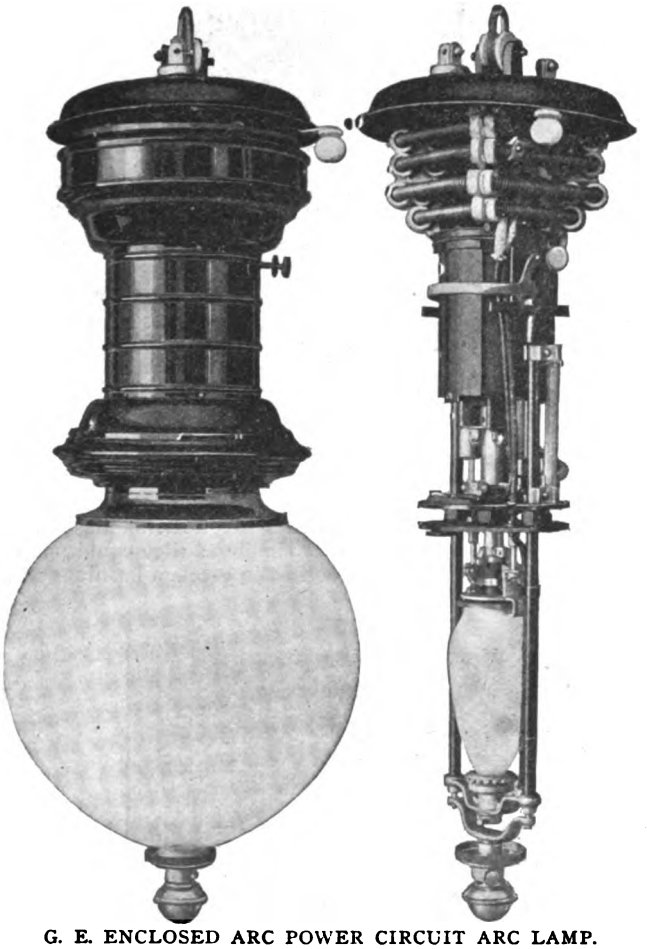
Digitized by Google

competition for efficiency in heating the car, the uniformity of its distribution of the heat, its economical consumption of current, its first-class mechanical construction, its neatness, its elegance of design and general appearance, and above all else its guaranteed durability. The Gold Street Car Heating Company state positively that this heater will always maintain its original condition in every particular, and they guarantee this fact to every purchaser.

Fig. 2 shows a new design of combination heater which the Gold Company are now producing. It uses the same means of supporting the resistance coils as are employed in all the improved Gold heaters, with the exception that the supports are carried in a series of extended circles within the heater. This heater is provided with a three-point switch so that three degrees of heat can be had as wished. It is ordinarily wired for 110-volt direct current circuit. Fig. 2 shows the appearance of the heater when used for warming a room, whereas Fig. 3 illustrates the heater as it would appear when boiling water or other liquid. As the illustration would indicate, this is also a very handsome design of heater, and it is one that has been much admired at the show room of the Gold Company.

G. E. Enclosed Arc Power Circuit Lamp.

FOLLOWING next in the line of enclosed arc lamps developed by the General Electric Company, a substantial, simple and efficient power circuit lamp has been perfected for use two in series on 220 volt circuits, or five in series on 500 volt circuits. It will be seen from the figures that in outward appearance it resembles the alternating direct current carbon feed enclosed arc lamps of the same company, and is manufactured in



G. E. ENCLOSED ARC POWER CIRCUIT ARC LAMP.

both single and double globe types. To conform to insurance regulations covering the use of arc lamps on high voltage circuits a safe, positive and reliable cut-out is incorporated in the lamp, together with an extra set of resistance coils. Should the carbons stick or the lamp for any reason fail to operate, the cut-out sends the current through these subsidiary resistance coils, instead of through the carbons, without detriment to the lamp. The efficiency of this cut-out has been demonstrated by cutting out lamps in circuit and allowing them to remain cut out for several consecutive hours, without resultant injury either to coils or lamp.

The mechanism is simple and made of but few parts. The carbon is fed by a double cam clutch, smooth and positive in action. An adjustable resistance in the upper part of the lamp allows it to be employed two in series on circuits of 200 to 240, or five in series on circuits of 500 to 600 volts. With one 12-inch positive and one 5½ negative ½-inch carbons, it burns after one trimming for from 130 to 150 hours, and after the run the remainder of the positive carbon can be used in the lower carbon holder for a second run of equal duration. The current required is five amperes.

The lamp is furnished with the globe-lowering device which has been fitted to over 30,000 General Electric enclosed arc lamps, and which permits the globe to be lowered gently by merely turning a milled thumb-screw at the side of the casing. The globe-holder is locked automatically by a single upward movement of the globe-holder. Power circuit lamps are furnished in weather-proof black or brass casings, the former being shown in the figure.

L. M. Rumsey Mfg. Co.

The "Shelby" tipless incandescent lamp will hereafter be carried in stock by the L. M. Rumsey Manufacturing Company, of St. Louis, Mo., who have arranged with the Shelby Electric Company for the handling of their product throughout the West and Southwest. The L. M. Rumsey Manufacturing Company is one of the oldest established houses in the Mississippi Valley, and their representatives will have, doubtless, introduced the "Shelby" lamp to every central station and isolated plant in the fifteen adjacent States within the next thirty days.

This arrangement makes it possible for the users of lamps to get the best possible service by reason of the full stock carried in St. Louis. And the fact that the article is offered by the L. M. Rumsey Manufacturing Company is, in that territory, a guarantee that it possesses high merit.

Loricated Conduits.

The Western Electrical Supply Company, of St. Louis, Missouri, have recently received some very large shipments of "Loricated" iron-armored conduit, and are to-day in a most excellent position to ship the day an order is received, which is a matter of great convenience to construction houses who are so often subjected to provoking delays in securing this class of material.

The Western Electrical Supply Company report some very large sales on the Loricated conduit since they took the agency, and see no reason why, with their excellent facilities and their usual energy, they should not make a success of it.

Incandescent Lamps in Kobe, Japan.

Consul Lyon writes from Hiogo, September 28, 1898, that he has received a letter from K. Ikeda, president of the Kobé Electric Light Company at that port, in answer to the consul's inquiries relative to electric light supplies.

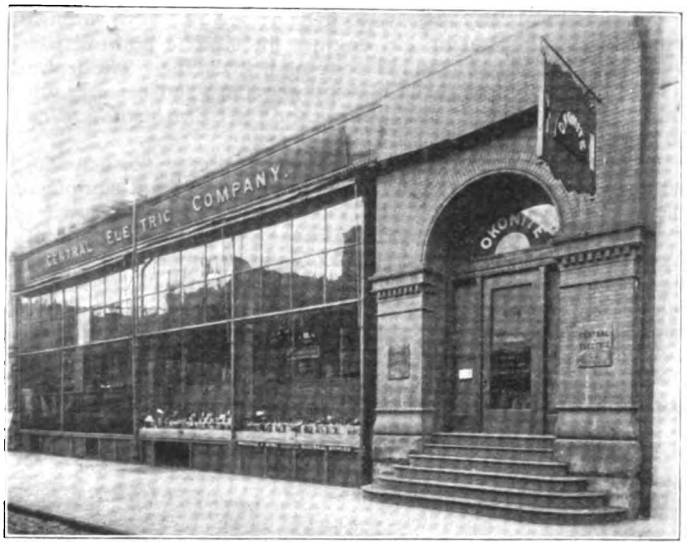
The company, the letter states, formerly used only the Edison lamp, but in 1894, changed to English and German lamps in consequence of their being cheaper; but it recognizes the superiority of the American or Edison lamp, and says that as it is desirable to use lamps requiring the least amount of power, machinery for testing lamps is now being put up, which when done may disclose that it should discard the cheaper English and German lamps and again use the Edison. The prices are given as follows: Lamps of 5, 8, 10, 16, and 24 candles, 32 sen (16 cents) apiece; 32 and 50 candles, 50 sen (25 cents)—this being the cost on delivery at Kobé.

ELECTRICAL BOOKS. The Electrical Engineer has just issued its new and revised book catalogue, which is the finest production of its kind. It consists of 64 closely printed pages, giving about 600 books in classes and in authors' alphabetical order. Many details as to price, contents, etc., are given, and in various ways the catalogue is most valuable to every reader, student and engineer. It will be sent postage free to any address on application to 120 Liberty street, New York City.

Digitized by Google

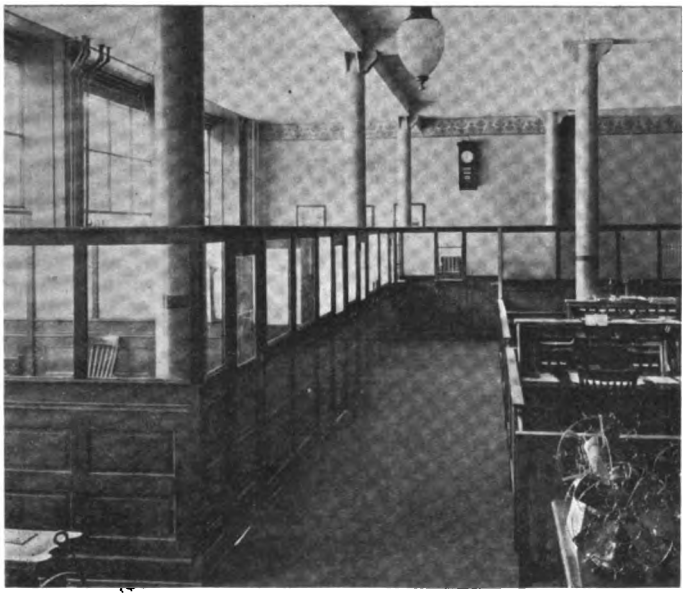
The New Home of the Central Electric Company.

THE high standard of their goods as well as the confidence placed in their management have compelled the Central Electric Company, of Chicago, to seek larger and more commodious quarters to carry on their growing business. Having outgrown their former abode this company have lately moved



NEW HOME OF THE CENTRAL ELECTRIC CO., CHICAGO.

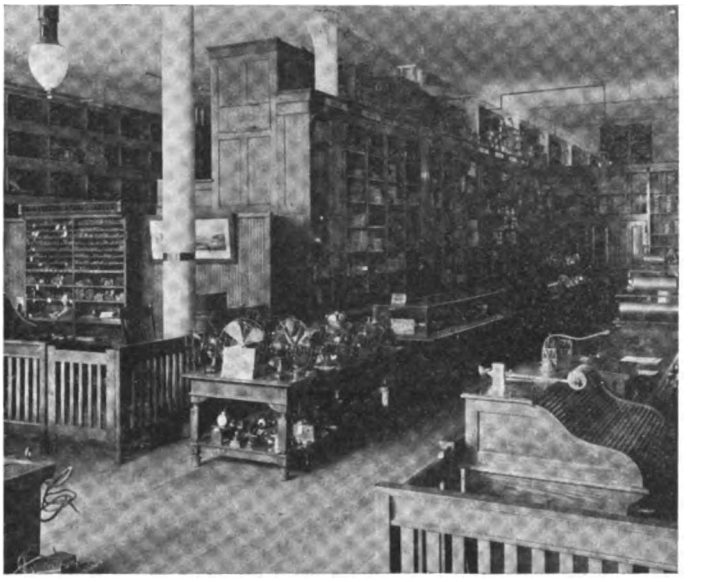
into the handsome building located at 264 to 270 Fifth avenue, between Jackson Boulevard and Van Buren street, Chicago. As one nears this building, he is confronted by two large signs, which for a long time have been inseparably connected, namely, the name of the company and the word "Okonite," which is placed above the main entrance. As the visitor passes through this entrance he finds himself in the retail and house goods department, which is filled from wall to wall with counters, bins and shelving. Here can be found properly arranged and easily



EXECUTIVE OFFICES, CENTRAL ELECTRIC CO., CHICAGO.

accessible everything that one can possibly call for in the way of electrical material, supplies and apparatus. Samples of motors, transformers and other goods are suitably arranged and displayed on various tables and platforms, while the many styles of switches, tools, testing instruments, etc., are exhibited on handsome panels and in wall cases. Mr. F. M. Pierce is the ruling spirit of this department and his long experience in the supply business has certainly fitted him eminently for this position.

As one turns to the left, the executive offices, accounting and general sales departments are passed, to which has been assigned the entire first floor front, securing for them an abundance of daylight and facilitating the dispatch of business. The private offices are occupied as follows: Charles E. Brown, secretary; George A. McKinlock, president and S. R. Frazier, treasurer. A spacious office intervening between the president's office and that of the secretary, is for the accommodation of the stenographers. The open offices at the front of the store are occupied by the chief order clerk, T. D. Lempke; general salesman and advertising manager, Charles G. Burton, and Messrs. J. M. Knox, and H. T. Conly, special and city salesmen.



RETAIL AND HOUSE GOODS DEPARTMENT, CENTRAL ELECTRIC CO., CHICAGO.

One of the most difficult problems which the company had to solve and which has been the stumbling block to many a supply house in the past, has been the arrangement of their stock room. This department, therefore, received special attention and the neatness of the arrangement and the facility with which everything can be handled, shows that great foresight has been used. The room is located to the left of the retail store and occupies the rest of the space across the building. Extending from wall to wall and built in tiers from floor to ceiling, with

SHIPPING ROOM, CENTRAL ELECTRIC CO., CHICAGO.

intermediate platforms to facilitate handling, are arranged a line of bins not very much short of a mile in length, if they should be placed end to end. One hundred and twenty of these are as-

Digitized by Google

signed to Okonite products alone. Besides, the company have stocked in these bins a great variety of switches and cut-outs, sockets and lamps, insulators and porcelain goods, carbons and brushes, cords and cables, staples and cleats, in fact everything electrical except the heavier stock which is kept in the basement. This is of sufficient size to hold 35 carloads of material with ease. The Company also make great specialty of telephonic work and do a great deal of business in that line. In the shipping room, loading and shipping platforms are conveniently arranged and they are daily lined with teams ready to distribute the shipment among the several freight depots.

This article is hardly complete, without saying a few words about the very energetic officers of the company. President George A. McKinlock, has been identified with this company since its inception and has placed it among the foremost supply houses in this country. He has been aided most cheerfully by the Secretary, Charles E. Brown, who has as at all times displayed an unusual capacity for hard work. The treasurer of the company, Mr. S. R. Frazier, has a remarkable knowledge of business and financial methods and has added his share in raising the company to its high standard ,of perfection. In wishing the company good luck and increasing patronage in their new home we are certainly expressing the sentiments of their numerous friends in the electrical community, as well as of ourselves.

ADVERTISERS' HINTS

B. F. STURTEVANT CO., Boston, Mass., advertise motors and generators for direct current from ¼ to 100 k. w. designed for direct connection or belt driving. Their bulletin, F, gives the details of this type of machine and any further information desired will readily be furnished on application.

THE AMERICAN REFLECTOR CO., Chicago, Ill., illustrate their lamp with a cut of their window reflector. This is intended to be placed in the top of a window not noticeable from the outside and the effect is to enhance the beauty of the goods displayed. This is also found to be exactly what is required in art galleries to make paintings appear to the best advantage.

VICTOR TELEPHONE MFG. CO., 166 So. Clinton street, Chicago, Ill., have several things to say regarding the construction of the Victor switchboard. They illustrate their ad. with 5 sections' drops and jacks. This apparatus is increasing in popularity daily.

SIPE & SIGLER, Cleveland, Ohio, are manufacturing a type of the Willard battery, especially adapted for service in motor vehicles. This battery has been an acknowledged success from its introduction, its construction being such as to insure the greatest efficiency with longest life.

NEW YORK PATENT BUREAU, Albany, N. Y., aims to assist the inventor in disposing of his invention or patent and to bring it before the proper authorities in whose line of business the patent or invention would be of value. A small fee is charged for the registration of the invention and on the sale of it a minimum percentage of the sale price is charged. Aside from this, it aims to assist the manufacturer in informing him of the particulars of each new invention bearing on the line of manufacture in which he is interested immediately upon its being brought out. They are ready to answer any queries which may be put to them.

COLUMBIA INCANDESCENT LAMP CO., St. Louis, Mo., show a picture of the home of the Columbia Incandescent lamp. They have just completed extensive alterations as well as additions to their capital, and are better than ever prepared to produce a lamp with the highest uniformity, candle-power and efficiency. They make prompt shipments from the factory and their branch offices and solicit correspondence with all interested parties.

THE O. C. WHITE CO., Worcester, Mass., advertise adjustable fixtures for incandescent lamps for their practicable requirement in many styles, sizes and finishes for shops, offices, libraries, etc.

THE AMERICAN VITRIFIED CONDUIT CO., of which Mr. C. J. Field is general manager and chief engineer, have removed from 20 Broad street, and now occupy more spacious and convenient quarters at 39 Cortlandt street, New York. They have been attended with considerable success in the introduction of their conduits, their sales, meanwhile, steadily increasing.

WESTERN NOTES

MILLER IMPROVED GAS ENGINE CO., of Springfield, Ohio, are manufacturing gas engines for electric lighting from 25 to 300 h. p. direct coupled units or belted type. The feature of this engine is said to be its high economy and close regulation; they guarantee a regulation within 3 per cent. from no load to full load.

BUTTE, NEB. Mr. J. C. Welles, of the Perry Townsite Co., writes us that they are in the market now for the full equipment of an electric light plant and water plant. The new town of Perry is at the terminus of the Atkinson & Northern Railroad. The company will need one 1,000 light dynamo, one 25 arc lighter, two 80 h. p. water wheels, shafting, wire, electrical supplies, etc. The waterworks will need two 1,500,000-gallon pumps and about three miles of piping for mains.

CONTENTS.

EDITORIALS:
Prices for City Arc Lights 486
Mr. Tesla and the Czar 486
A Timely Warning 487
MISCELLANEOUS:
High Frequency Oscillators for Electro-Therapeutic and Other Purposes (illustr.) ..... Nikola Tesla. 477
Mr. Rosenbaum Before the Franklin Institute on Electrical Invention 481
The Loss of the "Mohegan."—Ventilation of Hoosac Railway Tunnel 482
POWER TRANSMISSION:
The Electrical Equipment of the Conkey Printing Establishment. —II. (illustr.) ..... George A. Damon. 482
ELECTRIC TRANSPORTATION:
The Multiple Unit System ..... J. R. Cravath. 488
A Trolley Road for Honolulu.—Electric Bus in Berlin 488
ELECTRIC LIGHTING:
The Baggett Fuse Repair Screw Driver and Portable Lamp Socket (illustr.) 489
NEWS AND NOTES:
Tesla's Electrical Control of Moving Vessels or Vehicles at a Distance (illustr.) 489
Regulations at the Paris Exposition (illustr.).—Exports of Electrical Material from New York.—The Louisville Experiments in Water Purification 491
New Power Cable Conduit at Niagara (illustr.).—Struck by Lightning Two Hundred Times 492
TELEPHONY AND TELEGRAPHY:
New Postal Telegraph Headquarters in Kansas City, Mo. (illustr.) .. 492
The Use of the Intercommunicating Telephone System in Large Cities (illustr.) 493
The Schmidt Movable Telephone Arm Without Connection Cord (illustr.).—The Telegraph Line from Cape Town to Cairo 494
MUNICIPAL AFFAIRS:
Detroit a Poor Example 494
MECHANICS FAIR:
Various Interesting Exhibits 495
LEGAL NOTES:
Liability for Jerking of Trolley Car.—Revenue Stamps on Express Receipts.—Marks' Enclosed Arc Lamp Method Patent Sustained. 496
LITERATURE:
Anthony's "Lecture Notes on a Theory of Electrical Measurements." 496
INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents Issued Nov. 1, 1898 ... 497
Classified Digest of U. S. Electrical Patents Issued Nov. 8, 1898 ... 497
MARRIED:
Danforth—Johns.—Splitdorf—Urban 498
PERSONAL:
Mr. C. Lambdin.—Mr. John McGhie.—Hon. G. C. Sims.—Mr. W. J. Clark.—Mr. W. A. Eddy.—Mr. Lewis Searing.—Mr. W. Lindsay 498
OBITUARY:
Horace B. Miller.—Latimer Clark.—A. De Meritens 498
THE STOCK MARKET:
A Sound Money Victory and Better Times 499
TRADE NOTES AND NOVELTIES:
Foster's "Electrical Engineers' Pocket Book."—Lighting Fixtures, Both Gas and Electric as Made by the Horn & Brannen Mfg. Co., Philadelphia, Pa. (illustr.) 501
G. E. Enclosed Arc Power Circuit Lamp (illustr.).—L. M. Rumsey Mfg. Co.—Loricated Conduits.—Incandescent Lamps in Kobe, Japan 502
New Home of the Central Electric Co. 503
Advertisers' Hints.—Western Notes. 504

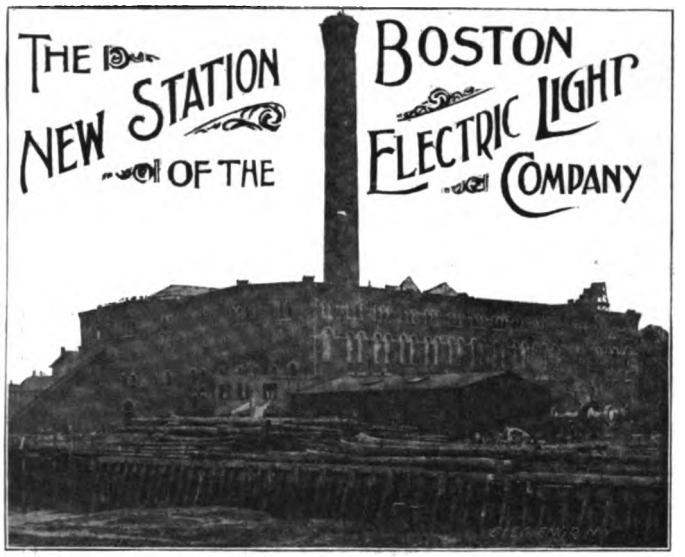
Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. NOVEMBER 24, 1898. No. 551.

ELECTRIC LIGHTING.



UP to recently the Boston Electric Light Company has operated a number of stations throughout the city of Boston, Mass., supplying both arc and alternating current incandescent lighting for the city and for private customers. When the construction was begun on the new Union Railway Depot, it was necessary to abandon two of the electric stations, so the company decided to consolidate all the small stations in one large plant, located in South Boston, from which current could be distributed by the three-phase system, this being selected on account of the ease with which it could be transmitted over the long distance which separated the new station from the principal centres of demand, and also on account of the fact that with the alternating current, it would not be necessary to disturb the present distributing system. The construction of this station, which is now nearing completion, presents an interesting example of the concentration of power stations that are becoming more frequent as the possibilities of the alternating current are becoming appreciated.

The new power house, shown in Fig. 1, is situated on the property purchased from the Harrison Loring Co., who were engaged in shipbuilding for many years. The power house is located within 100 feet of tide water, from which condensing water is obtained. The general design of the building closely follows modern practice, being of fireproof construction and of the usual arrangement. The building measures 244 feet long and 173 feet 8 inches wide, and is divided by two internal walls into an engine and boiler room and coal pocket, all of a length equal to that of the building, and 82, 52 and 30 feet wide on the clear respectively. The engine room floor is 39 feet below the tracks of a traveling crane and 46½ feet from the roof truss. The roof is of steel and is supported by steel columns carried up from the foundations in brick walls. The Pennsylvania Steel Company furnished the steel work, which is plainly visible in Fig. 2. The roof is nearly flat, sloping toward a copper gutter over the wall dividing the engine and boiler room. The roof purlins are 7-inch 15-pound I beams, between which flat hollow tile arches are sprung. Over this 2 x 10-inch soft pine is laid, which is covered with tar and gravel. For the purpose of giving light a glass monitor is placed in the roof over the boiler room. The sides of the monitor contain louvers for ventilating purposes.

The construction of the coal pocket, shown in the plan, Fig.

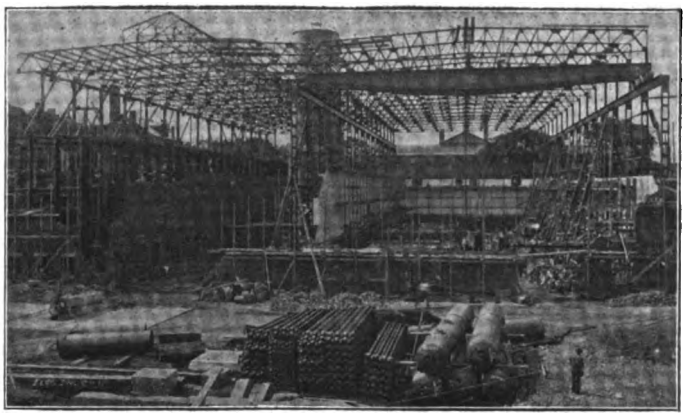


FIG. 2.—THE BOSTON ELECTRIC LIGHT CO.'S NEW STATION AS IT APPEARED JULY 11, 1898.

3, is novel and interesting. Imbedded in the brick wall surrounding the coal pocket are 20-inch 65-pound I beams placed on 8-foot centres, and supported by a continuous concrete footing capped by foundation stones to which the columns are bolted. Across the top of the coal pocket are 18-inch 50-pound I beams tying the walls together and also supporting the coal carrying machinery. The floor of the coal pocket is supported by 20-inch 65-pound I beam girders connecting each pair of opposite columns. The upper flanges of the girders are 9 feet above the boiler room floor. The girders are connected by I beams, between which brick arches 24 inches thick are sprung. The middle of the girders is supported by two 10-inch Phoenix columns founded on continuous concrete blocks. Between the columns separating the coal pocket from the boiler room heavy arches are sprung.

An unusual arrangement is provided for ventilating the coal so that spontaneous combustion will not occur. At every column around the coal pocket is a square pipe with bell and spigot end, something like a sewer pipe, attached with the bell end downward to the inner flange of the columns. A space is left between the spigot of one pipe and the adjacent bell end of the pipe above. The projecting and overhanging bell prevents the coal from entering the pipe, but allows gases that might distill from the coal to find their way to the atmosphere through the ventilating pipes.

The design of the station, shown in Fig. 3, contemplates six engines each directly connected to a 1,500 k. w. generator. For each engine a pair of boilers each of 500 h. p. is to be installed. Three McIntosh & Seymour engines of the vertical cross-compound condensing type have been installed. Each engine is pro-

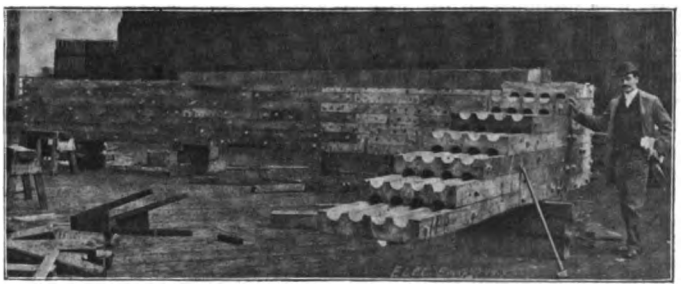


FIG. 4.—THE WOODEN CONDUIT IN COURSE OF CONSTRUCTION, SHOWING ITS RELATIVE SIZE.

vided with cylinders 28 and 58 inches in diameter and 48-inch stroke, and is intended to develop 3,000 h. p. with a steam pressure of 160 pounds and a speed of 120 revolutions per

Digitized by Google

minute. The valves are of the gridiron type, and the valves on both cylinders are provided with an automatic cut-off under the control of a shaft governor. The revolving fields of the generator are attached to a shaft between the crank discs, as is also a 16-foot fly wheel weighing 100,000 pounds. The bearings are two in number and each is 21 inches in diameter and 42 inches long. Each engine is provided with a Blake vertical twin air pump and jet condenser. Each steam cylinder of the air pump is 14 inches in diameter and has a stroke of 21 inches. The air pump bucket plunger is 32 inches in diameter.

The electrical equipment was furnished by the General Electric Company. Each generator is of 1,500 k. w. and delivers three-phase current. They are of the revolving field type so as to generate current at 2,250 volts without the use of rising transformers. Each generator has 60 poles and the speed of 120 revolutions per minute gives a frequency of 60 cycles per second. To excite the dynamos two small direct current machines each connected to an Ames simple engine are provided. For the supply of the 5,000 arc lights now operated by the company, it is intended to install in the space opposite the engines twenty 200 h. p. synchronous motors each driving two 125 arc machines. The armatures of the motor and arc dynamos are to be keyed to one shaft, the three being mounted on a single bed plate. For the small amount of direct current now supplied by the company for power purposes, it is intended to transmit from the new station by the three-phase current to two 500 k. w. rotary converters, located near the centre of demand and delivering direct current at 500 volts. For the incandescent lighting system, the three-phase wires will simply be joined to the existing distribution system, using the transformers now in use.

The boiler plant, as has been said, will consist of twelve boilers, set in six batteries of two each. Four batteries are now in place. The boilers are of Babcock & Wilcox make, and each contains 50 square feet of heating and 88 square feet of grate surface. The boilers are equipped with the Hawley downdraft furnace. The waste gases from each boiler pass into a brick flue 14 by 6 feet in size and supported by I beams built into the boiler room floor walls and the boiler setting. The flue is lined with fire brick.

The chimney is of brick, 225 feet high and 11 feet in diameter on the inside. Its base is founded on a bed of concrete 14 feet thick and 40 feet square. Beneath the base of the chimney is a grillage of 8-inch I beams 24 feet long, and placed on 2 feet centres. The base of the chimney proper is hexagonal, 22 feet from face to face. The chimney is constructed with a double wall, and the space between is connected by a system of iron flues to small openings in the upper part of the engine room wall, so as to ventilate the engine room.

The coal handling system was supplied by the C. W. Hunt Company, of New York City. Coal is brought in barges alongside of a wharf that extends out in the harbor, and is unloaded by buckets into a Hunt coal conveyor, which runs along the wharf and up on an incline to the coal pocket next the boiler room, where 9,000 tons can be stored. Chutes at the bottom of the pocket lead to the boiler room floor. Small cars may be run under the pocket and the coal drawn from the pocket at openings in the bottom of the pocket, and near the outside wall if desired.

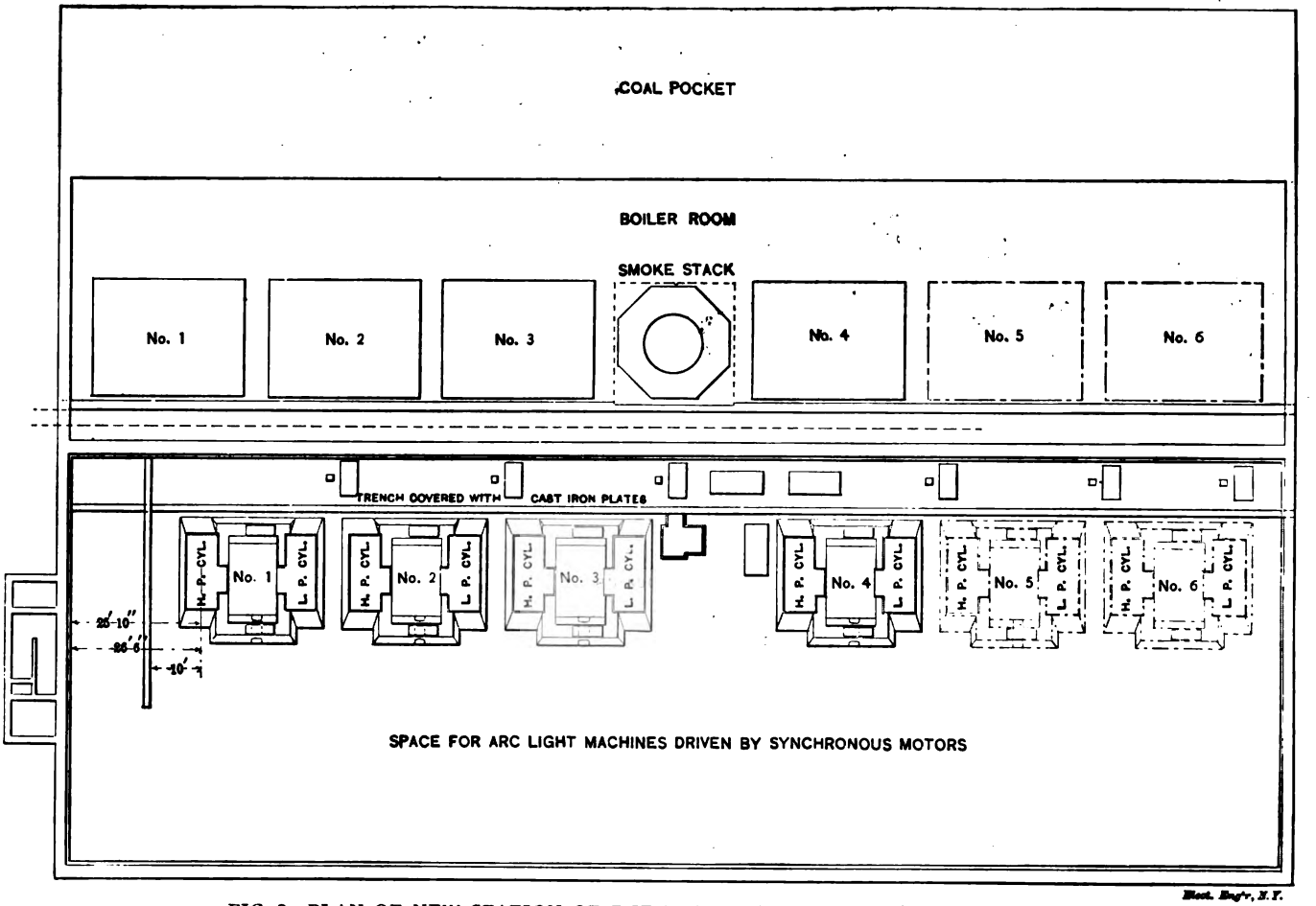


FIG. 8.—PLAN OF NEW STATION OF THE BOSTON ELECTRIC LIGHT COMPANY.

Much thought has been given to the steam piping, and a very economical system has been developed. From each boiler a 10-inch pipe rises and crosses over and drops into a 20-inch main supported by several adjustable brackets bolted to the boiler room wall. From the top of the main a 12-inch copper bend rises in the loop, so as to make ample room for a stop valve and separator on the boiler side of the wall, then crosses to the engine. One feature in the piping worthy of particular attention is the provision made by means of gearing and shafts for controlling all the valves from the floor. The two valves in each boiler connection are controlled from the boiler room floor, and the valves in the pipe leading to each engine, and the large gate valves that are placed in the steam main to separate each pair of boilers and the engine they supply from the remainder of the piping system are both controlled from the engine room. The importance of this arrangement in case of a steam pipe explosion or damage to any part of the

Digitized by Google

plant necessitating an immediate shutdown can easily be appreciated. Chapman valves are used in the station.

The exhaust steam passes horizontally from the low pressure cylinder of each engine to the base of a free exhaust pipe. A branch from the horizontal pipes drops directly into the top of the jet condenser, but there are two tees in this pipe from which connections lead to a closed feed water heater of the National Pipe Bending Co.'s make. When this is in use a valve between the tees is closed. The heater may be cut out if desired. The free exhaust is provided with the usual relief valve which opens if any accident should occur to the condenser.

The care of drips and utilization of exhaust from the auxiliaries is an important and interesting point in the design of the station. Both cylinders of the engines and the receiver are jacketed with boiler pressure steam, and these are trapped into a high pressure drip main which also receives the drip of all the high

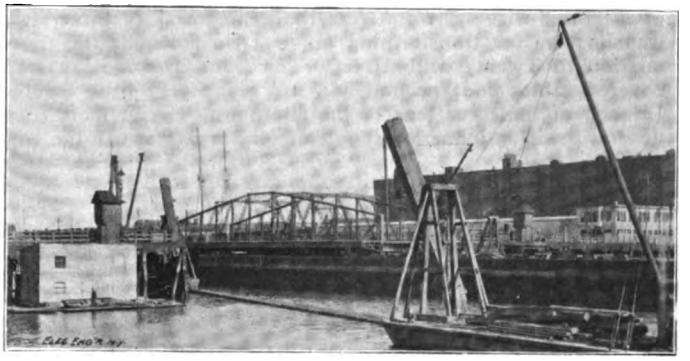


FIG. 5.—THE WOODEN CONDUIT AT CONGRESS STREET BRIDGE, JUST BEFORE SINKING, IN POSITION.

pressure piping. An automatically governed pump and receiver will return this hot water to the main feed line. The exhaust of the air pump is led hither into the condenser or to a second or auxiliary heater, the first receiving the steam from the main engine and only raising the feed temperature to about 130 degrees Fahr. The exhaust of the exciter engine will be turned into the receiver of the main engine and used in the low pressure cylinder. It may, however, be led to the condenser direct, or to the auxiliary feed water heater or to the atmosphere.

The injection water for the condensers is drawn from the bay by means of a 48-inch cast-iron pipe which terminates at the wall of the power house in a sluice 8 feet deep and 3 feet wide. The bottom of this sluice is of concrete 6 inches deep, and the sides are of 4-inch creosoted pine timber, backed with 2-inch pine. Opposite each condenser, a square brick shaft connecting with the top of the sluice is provided, and the injection pipe from the condenser extends down this to the water in the sluice. The bottom of the sluice is 18 feet below the bottom of the condenser pit, and considerably below mean low tide. The cast-iron pipe is provided with a Chapman gate valve located in a gate chamber outside the power house. The discharge from each condenser passes into a 36-inch cast-iron pipe extending out into the bay.

The feed water for the boilers is supplied by three Goulds triplex pumps, with plungers 8 inches in diameter and 10 inch stroke. Each pump is directly connected to a General Electric synchronous motor running at 900 revolutions per minute. The pumps are located in the engine room about opposite the chimney. Each pipe draws its supply from a connection with the city main, and forces it into a 6-inch main that is carried lengthwise of the engine room between the engines and feed water heaters, of which there are two for each pair of boilers. The water may be passed through either one or both of the heaters in series. From the heaters the water passes into a 6-inch feed pipe in the boiler room which has a branch to each pair of boilers. The feed water from the pumps may pass into the front or rear of the drum of each boiler at the V branch. The feed water line to each pair of boilers divides into a branch to each boiler. Cold water from the city mains at the rear of the boilers may be supplied to the boilers by an injector, or it may pass into the boilers direct when the pressure on the boilers is less than that of the city supply. It should also be mentioned that water from the pumps may by-pass both heaters if desired. The contractors for the piping in the station were Messrs. Best, Fox & Company of Pittsburg.

The cables from the power station into the city mains will be

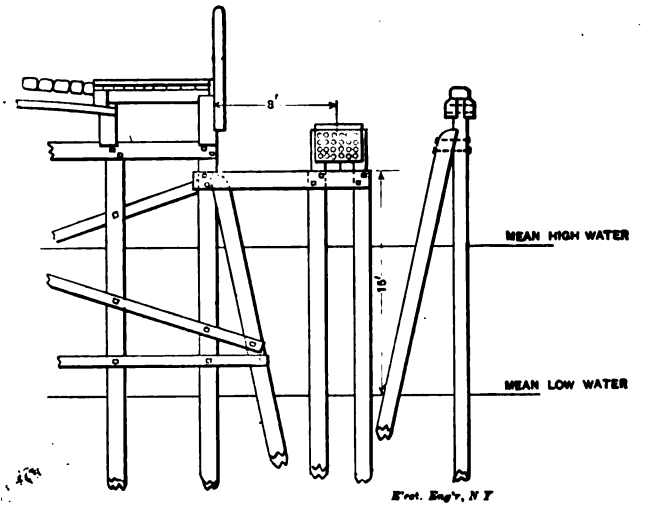


FIG. 6.—SECTION SHOWING CONDUIT ON PILES.

carried in two double conduits each of the usual type of cement lined pipe bedded in concrete except at the river crossing where U-shaped conduits of the cross section shown in Fig. 4 are used. The horizontal bottom of these subaqueous sections is placed in a trench dredged to receive it, and is joined to the vertical legs by curves with a radius of about 20 feet. The conduit is built of 6x14-inch green pine, grooved on a buzz planer so as to give 24 ducts when assembled, except for a 12-foot length where each leg emerges from the mud, which is made of similarly grooved oak timbers to avoid trouble from the teredo. The timbers are held together by galvanized iron bolts and kiln dried soft pine pins, the former being regarded as temporary fastening of sufficient durability to last until the pins swell and thus bind all the parts together.

The conduit was manufactured by the company's men. The finished timbers were turned out in lengths of 4 feet for the curves and running to as much as 20 feet in some straight sticks. They were assembled temporarily in short lengths, and each duct was measured by a template run through it from end to end. If the ducts were too small at any place, the timbers were taken apart and the narrow places gouged out. When a section was finally bolted and doweled together, the ends of each duct were slightly flared so as to avoid any projections at the junctions of two sections, and was launched from a greased incline. The ends of the sections were stepped off, and the final jointing was made while the pieces were floating. When the entire conduit was finished, the two legs were lifted by lighters shown in Fig. 5, and the horizontal part weighted until it dropped into the trench prepared for it. The lead covered cables in the ducts are divided at the top of the legs and carried into two entirely independent manholes, so that any accident to one set will not cripple the other. Figs. 6 and 7 show the exact position of the conduit with respect to the Congress street bridge.

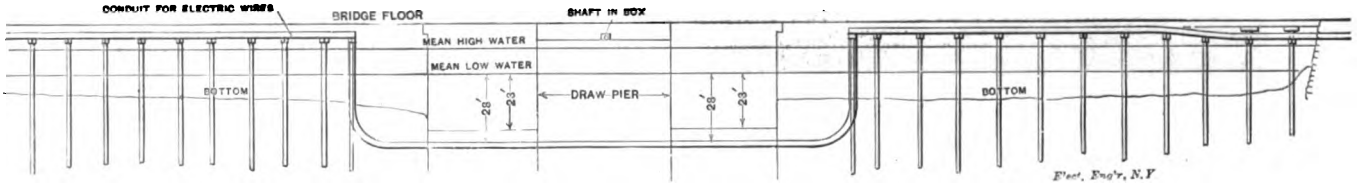


FIG. 7.—POSITION OF WOODEN CONDUIT ACROSS FORT POINT CHANNEL AT CONGRESS ST. BRIDGE.

Digitized by Google

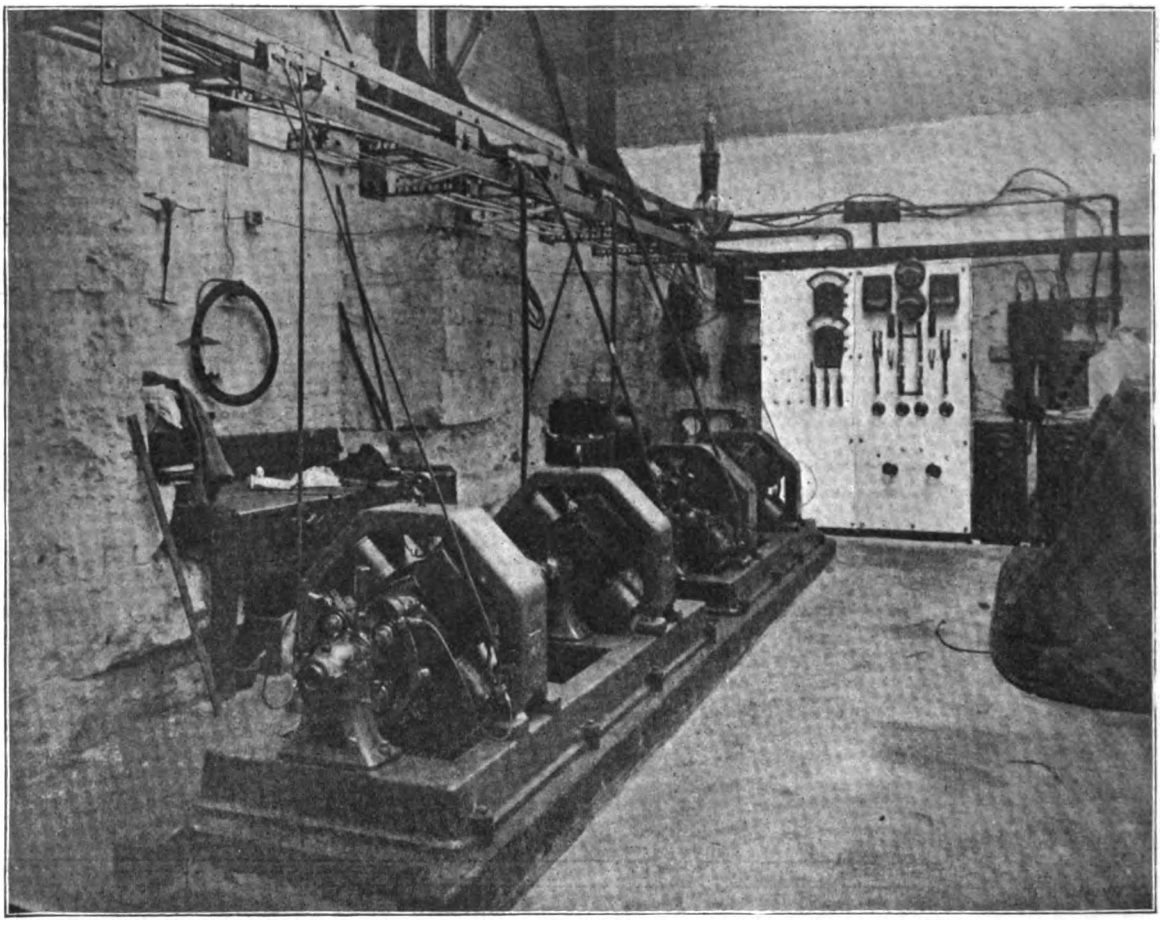
We are indebted to Mr. F. A. Gilbert, president of the Boston Electric Light Company, for the material from which the preceding article was prepared. We are also under obligation to Mr. Sidney Hosmer, assistant general manager; to Mr. H. W. Ball, C. E., who designed the structural details of the power station; and to Mr. Bert. Houghton, resident engineer, for similar assistance. Messrs. Sidney Hosmer and L. L. Elden are the electrical engineers of the company, and Mr. James T. Boyd was the deigner of the details of the mechanical plant.

New Work in the Chicago Edison Station at Harrison Street.

THE Harrison street station of the Chicago Edison Company has recently seen the installation of some new apparatus which will be of interest to readers of The Electrical Engineer.

The Harrison street station of this company is the main central generating station supplying the downtown district, and was exhaustively described along with the other features of this company's system in The Electrical Engineer of Jan. 23, 1895. About a year ago a three-phase motor generator was put in this station in order to transmit power at a high voltage to the station at Wabash avenue, near Twenty-sixth street. This Twenty-sixth street station is about two miles and a half from the Harrison street station, and supplies a residence district on the south side. The three-phase motor generator was of small capacity, and the main object of the transmission was to enable the steam plant at the Twenty-sixth street station to be shut down during hours of light load. The increase in labor at the Harrison street plant, due to the load of the Twenty-sixth street station, was practically nil, and with the superior economy of generation at the Harrison street station there was a marked saving. The Twenty-sixth street station has high-speed engines belted to small dynamos, so that the loss in transformation and transmission from Harrison street was compensated for by the economy of the large compound-condensing direct-connected engines at Harrison street, and the labor saved by shutting down the steam plant at the Twenty-sixth street station was clear gain.

In the last few months another advance has been made in the way of alternating current transmission by the addition to the generating units of the Harrison street station of two 400 kilowatt generators direct-connected to a vertical Southwark compound-condensing engine. The generators are arranged to give either direct current at 110 to 150 volts for feeding into the regular direct current bus-bars supplying the three-wire network, or to give a three-phase alternating current for the transmission to the Twenty-sixth street station. These generators were built by the General Electric Co., and are said to be the first of the type produced. The direct current commutators are of large diameter and extend out over the collecting rings on the shaft which deliver the alternating current. The two generators are placed one on each end of the engine shaft according to the usual arrangement in Edison stations for supplying the two sides of the three-wire system. Near the generators are three static transformers for transforming up to 4,500 volts for the transmission to Twenty-sixth street. The transmission is in lead-covered cables underground and has given very little trouble. In each of the three legs of the alternating circuit from these generators, is an induction regulator for varying at will the voltage of the alternating current. These regulators can be altered either by turning a hand-wheel or from the switchboard by tiny induction motors placed on the regulators and geared to the hand-wheel shafts. In the main 4,500-volt circuit is a three-pole switch worked by compressed air and making its break under oil. This switch is placed in an out-of-the-way corner and is worked entirely by air valves on the switchboard gallery. The voltage of the generator when working on a direct current load can be varied of course in the usual way. These generators were put in to take the peak of the load on the Twenty-sixth street station, and also help on the Harrison street station peak. The heaviest load on the Harrison street station, which carries the down-town district, comes before six o'clock in the evening. The heavy load on the Twenty-sixth street station comes after



BOOSTERS IN HARRISON STREET STATION OF CHICAGO EDISON COMPANY.

Digitized by Google

six o'clock in the evening. The same engine and generators can therefore be used for both.

A couple of boosters have also been put in this station recently for temporarily supplying a long feeder reaching out into new territory. This feeder runs out to Blue Island avenue, and is 6,290 feet long of 350,000 circular mils. Two boosters of 12½ k. w. each have been put in, one for each side of the three-wire system. The accompanying engraving shows the two boosters with the motors which drive them. Each booster is mounted on the same bed plate as the motor which drives it, and all four machines are put in line on a wooden sub-base. The boosters are inside, next to each other, and the motors on the ends. The couplings are so arranged that it is possible to connect the two boosters together and run them from one motor at half-load in case the other motor should break down. The motors are shunt wound, 250 volt, and run across the outside mains of the three-wire system. The boosters are compound wound and will give 50 volts with a fully excited field, one-half of which is due to the series field and one-half to the shunt field. One of the reasons for using a shunt winding on the fields is to prevent the booster from running away in case the fuse supplying the motor circuit should blow. There have been a number of disastrous accidents of this kind, taking the country over, and it is a possibility the operators of boosters can not afford to overlook. It is the aim here to always keep enough shunt field excitation so that the series field can not overcome it and make the booster run away in case the booster motive power gives out.

The Wright Discount Meter and Its Use in Central Station Management.

THE Wright Discount Meter, used extensively in this country and abroad, and to which frequent reference has been made in our columns, is a maximum recording ampere meter for either direct or alternating currents, and records the maximum amperes that have passed through it at any one time since it was last set. It is purposely made slow acting for the reason that any portion of the plant of an electric company will stand a very large overload for a minute or two, and a less overload for a longer time. The meter is therefore so designed that if the maximum load lasts only five minutes, the meter will register about 80 per cent.; if ten minutes, 95 per cent., and the full 100 per cent when the load has continued half an hour.

Fig. 1 shows the working parts in principle. A liquid is hermetically sealed in a glass bulb, around which the wires or heating strip pass as shown. The passage of the current heats the air in the left hand bulb and the expansion of the air forces the liquid into the right hand bulb and indicating tube. The liquid when once spilled over into the indicating tube cannot return until the meter is reset.

Figs. 2 and 3 are respectively exterior and interior views of

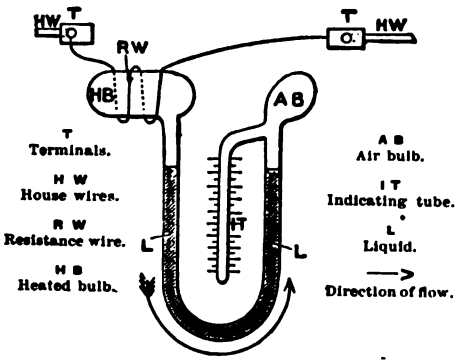


FIG. 1.—CONNECTIONS OF WRIGHT'S DISCOUNT METER.

the actual meter. The working parts are enclosed in an iron case (which can be securely sealed against tampering), fitted with a glass front so that the meter can be read without having to open the hinged door. The case is so constructed that the meter can be placed in any locality without the slightest danger of damage, and as the only moving part is the liquid, which is hermetically sealed in the tube, it is practically impossible for the meter to get out of order.

Referring to Fig. 3, it will be seen that the glass tube is carried on a substantial backing, which is so hinged that the meter can be reset by tipping up the tube and allowing the liquid to run back out of the indicating tube into the side tubes.

On account of the inability to store large quantities of electrical energy for future delivery, the electric power station is forced to manufacture the greater portion of its output at the time of the customer's demand. The result of this condition is that the company operating the station has to carry a very

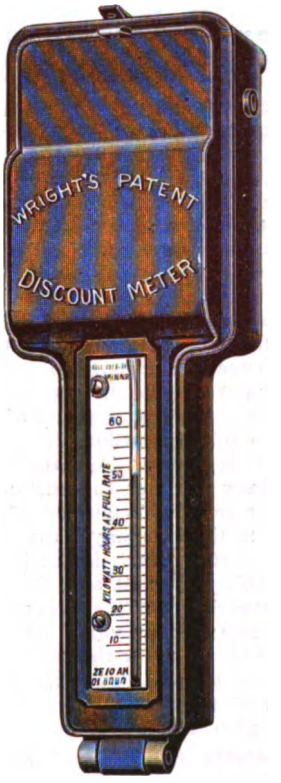


FIG. 2.—WRIGHT'S DISCOUNT METER, CLOSED.

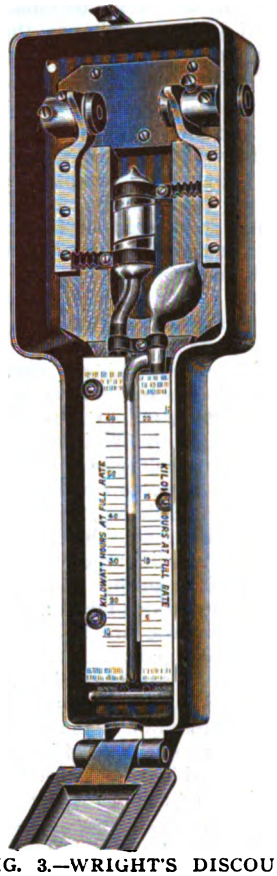


FIG. 3.—WRIGHT'S DISCOUNT METER, OPEN

large investment which, for a considerable period of the day, must remain idle, this period depending absolutely on the amount of time which the customer makes use of his maximum demand. Now, as the interest charges of a station are a very large proportion of its cost of production, it seems natural that the company can furnish electrical energy cheapest to the customer who uses his maximum demand on the station for the greatest number of hours each day; therefore it follows that electrical energy should be sold on a sliding scale, depending on the maximum demand of the customer and the total amount of electrical energy supplied.

These data can be secured by the use of the Wright discount meter. It is connected in series with the recording wattmeter, or chemical meter, and registers in amperes the maximum demand on the station at any one time. In order to be ready to supply this demand, the central station company has to reserve a certain proportion of its total investment, the interest on which the customer should certainly pay, besides the necessary cost of production and profit on the total amount of electrical energy used. To accomplish this the customer may be charged at one rate for the first hour's use of the maximum demand each day, and for all electrical energy used in excess of this at a much lower rate.

In order to facilitate the reading of the meter and the determination of the customer's bill, the Wright discount meter scale may be so calibrated that on one side it will read in amperes, and on the other directly in watt hours, without any calculation, the amount of electricity to be paid for monthly at the full rate.

To arrive at the amount of electricity to be paid for at the low rate, subtract the watt hours as shown by the reading of the Wright discount meter, from the watt hours as shown by the recording wattmeter or chemical meter, according to the type of meter used, and the difference between these two readings

Digitized by Google

will represent the watt hours to be charged for at the low rate.

For example, we will assume the meters to be connected on a 110 volt circuit and that the Wright discount meter reads 10 amperes on the ampere scale. On the watt hour scale the reading would be 33,000 watt hours (10x110x30), on the basis of charging the full rate for the equivalent of one hour's use of the maximum demand per day, thirty days each month. If the recording wattmeter or chemical meter shows a total consumption of 50,000 watt hours, then the customer will be charged at the full rate for 33,000 watt hours and at the low rate for 17,000 watt hours.

It is, of course, not absolutely essential that the system of charging above outlined be strictly adhered to, as it may be found in some cases advantageous to vary the details somewhat. One large company, instead of charging the full rate of the first hour's daily use of the maximum demand throughout the year, charges the full rate for the first half hour's daily use during the six summer months, and during the six winter months charges the full rate for the first hour and a half daily use of the maximum demand. In both summer and winter all of the excess consumption is charged for at a lower rate.

Another large company, who are now installing a number of Wright discount meters, vary each month the number of hours for which the full rate is charged, making gradations from 10 hours in midsummer months to 50 hours in midwinter months.

The use of the Wright discount meter is not confined to the above described system of charging, but may be used to great advantage by companies charging on a contract basis, with a fixed price per light per month, whose bills are ordinarily based on the number of lights connected. It is obvious, however, that it makes no difference to the company whether the customer has one light burned a long time, or two lights burned alternately, but it does make a difference to the company if the customer burns the two lights at the same time, since, in the latter case, the company must provide double the plant and the expense will be nearly doubled. If, however, the Wright discount meter is used, the company can tell exactly how much plant is necessary to supply each customer, and may allow the customer to wire for as many lights as he wishes without penalizing him for lights which are burned at different times from the others, and which therefore require no extra plant at the station.

What has been said regarding charging for light is equally applicable in charging for power. Especially so is this the case where power is sold at a contract price, depending on the rated horse power of the motor, as the customer invariably installs a machine larger than actually required. In order to protect itself the company is forced to base its bills on the rating of the motor, irrespective of the horse power actually used. This invariably leads to dissatisfaction and the customer feels that the company is taking advantage of him, producing in his mind, and ultimately in that of the general public, an impression that the company's policy is to "get the best" of their customers. Such an impression means loss of business. By the use of the Wright discount meter all this unpleasantness could be avoided. The customer would be charged in accordance with the horse power used as shown (in amperes on one side of the scale and directly in horse power if so desired on the other) by the meter. A further advantage would be that the company, instead of having to estimate, based on the rated horse power of motors connected, would know absolutely what was the demand for current on its power circuits, and could with certainty add customers until the demand reached that of its generating capacity.

The American companies using the Wright discount meter for determining price are: Edison Electric Illuminating Co., Boston, Mass.; Chicago Edison Co., Chicago, Ill.; Commonwealth Electric Co., Chicago, Ill.; Westbrook Light & Power Co., Westbrook, Me.; Edison Sault Electric Co., Sault Ste. Marie, Mich.; Cleveland Electric Illuminating Co., Cleveland, Ohio; Waverly Electric Light Co., Waverly, N. J.; Georgia Electric Light Co., Atlanta, Ga.; Edison Electric Illuminating Co., Detroit, Mich.; Cumberland Electric Light & Power Co., Nashville, Tenn.; Plainfield Gas & Electric Co., Plainfield, N. J.

It is well known that a transformer may be safely set to feed more lights than it would carry if they were all turned on at once. The transformer need be of a size fit to carry the maximum load only, but the maximum load may be equal to the number of lights connected, or it may be only one-quarter to one-fifth of the lights connected. In order to allow for the uncertainty of the maximum load, it is usually expedient to put in a larger transformer than would be necessary if the maximum load were known. If, however, a Wright discount meter is installed in series with the transformer, it will show the maximum, and the transformer may be chosen to fit the load it is to carry. If a transformer is put up without a Wright meter in a district where the load is growing, it must be replaced by a larger transformer before it is loaded to its rated capacity, or else there is risk that it will be overloaded and give poor service. If, however, a Wright meter is installed with the transformer, the load on the latter may be increased to a greater extent than would be safe without a meter.

Some companies keep Wright meters in series with their transformers, year in and year out, and find that the saving in investment by using transformers adapted to the load is enough to pay the first cost of the meters. The saving in core loss is an additional economy which, in many cases, is even more important than the saving in first cost.

The principle which has been described in connection with transformers also applies to the use of the meter in connection with feeders and mains, especially in growing districts.

The following companies are using the Wright discount meter for testing transformers: Brookline Gas Co., Brookline, Mass.; Edison Sault Electric Co., Sault Ste. Marie, Mich.; Narragansett Electric Light Co., Providence, R. I.; Fall River Electric Light Co., Fall River, Mass.

The uses of the Wright discount meter are so varied and it fills such a long-felt want of the electric light and power companies, that every central station manager should make himself thoroughly familiar with this simple and useful instrument.

Discussion of the Conkey Printing Plant Transmission.

At the meeting of the Chicago Electrical Association, Nov. 4, 1898, when the paper was read by Mr. George A. Damon, on the electrical equipment of the large printing plant of the W. B. Conkey Company, at Hammond, Ind., an interesting discussion followed the paper, which has already been printed in The Electrical Engineer.

Mr. H. H. Cutler spoke of some of the points about the control of the printing press motors. The motors used are of extremely slow speed, and of the Lundell type. The field windings on this motor consist simply of two circular coils, one for shunt and one for series. This form of field is very convenient for speed regulation by cutting out part of the series coils, as it can be done easily without unbalancing the fields as would be the case with the ordinary form of multipolar motor, unless all the sections of the series fields have an equal number of turns on all the poles, a thing not always easy to accomplish. In printing plants there is considerable difference of opinion as to the desirability of using two circuits of different voltages for the purpose of obtaining a wide variation in speed. With one voltage it is necessary to use armature resistance to get a speed variation over the 25 per cent. which varying the field strength will give; and this insertion of resistance in the armature circuit is fatal to good regulation with varying loads. He further mentioned the importance of providing a path for the discharge of the field circuit of a shunt motor when the circuit is opened, and the disastrous results that sometimes followed the non-observance of this precaution. Some work had been done in the Conkey plant in the line of controlling the speed of the motors so as to give a variable speed to a press bed, making the action of a press something like that of a planer—that is, running the bed slowly while taking the impression and fast for the return.

Mr. Damon, on request, further described the lock device used to keep the pressmen from running presses at less than the speed the foreman wishes. It has been found that when the press speed is as easily controlled as it is with the electric motor the press feeders sometimes like to take things easy when the foreman is not around by reducing the motor speed, so that they

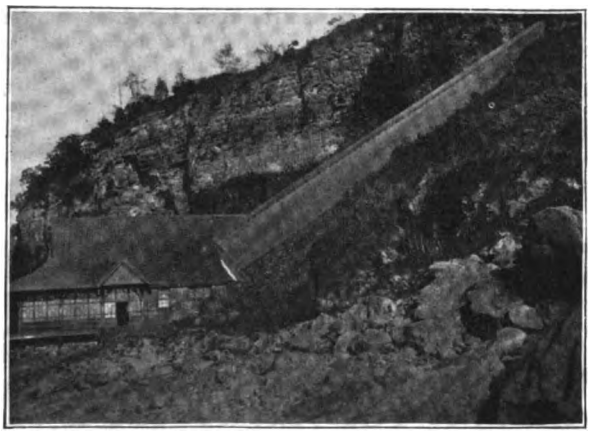
Digitized by Google

will not have to feed as fast. To prevent this a device is put on the controllers, whereby they will not lock at anything less than the full speed for which the foreman sets them. This makes it perfectly easy for the feeder to stop and start with his controller, but as the rheostat controller arm will not catch at less than the full speed for which it is set, and as the feeder cannot hold the controller handle and feed the press as well, at the same time, he cannot do otherwise than run his press continuously at the right speed.

Mr. Roe gave it as his opinion that a great number of speeds are not called for by practical printers, and that it is unnecesary to have controllers providing for a great variety. This brought out the fact in the discussion that printers differ in their notions of what is necessary in this respect.

Operation by Electricity of the Prospect Park Incline, Niagara.

THE Commissioners of the New York State Reservation at Niagara are about to adopt electricity to operate the inclined railway in Prospect Park, and in making this change the commissioners make a notable departure in what has been the policy of the Board of Commissioners in the past in their treatment of the several power companies, especially the Niagara Falls Power Company. Ever since it was constructed, the incline has been operated by water power. It has been found by experience, however, that very frequently during the severe weather in winter when the intake was clogged by ice or there was low water, the supply of water was not sufficient to operate the incline, and for this reason many times when there has been an ice bridge, and many people were desirous of going down and crossing the bridge, they were forced to walk up and down the long, tiresome stairway. This non-operation of the cars resulted in a large financial loss to the State, and it is conceived



INCLINED PLANE, AMERICAN FALLS, NIAGARA, TO BE OPERATED ELECTRICALLY.

that by the electrical operation of the cars the incline will be in continuous service, thereby increasing its revenue-producing powers.

Plans and bids are now being solicited from the principal electrical companies, and when the change is made, it is altogether likely that the Niagara Falls Power Company will be called upon to furnish the current necessary to the operation of the new plant. Such supply of electricity on the part of the Niagara Falls Power Company will be in keeping with Chapter 513 of the laws of 1892, under which the Niagara Falls Power Company secured valuable rights, as follows:

Sec. 2—Said corporation, its successors and assigns, shall have the right to take and use the waters of the Niagara River at the points hereto authorized and at any points on or opposite to any riparian land now owned by said corporation, up to and including a part of the lot 49 mile reserve, so called, to the extent required by the proper operation of the authorized works of said corporation during the continuance of said works; this right being granted upon the express condition that its acceptance shall bind said corporation to furnish free of charge electricity for light, and also for power (so soon as said corporation shall begin to furnish electrical power in Niagara Falls), and also water for the use of the State in the State reservation at Niagara and the public buildings thereon, when requested by the commissioners of the State reservation; provided, that nothing contained herein or in any of the former acts concerning said corporation shall be so construed as to confer an exclusive right nor any right to infringe upon the State reservation, or to obstruct the navigation of the Niagara River, or to take therefrom more water than shall be sufficient to produce 200,000 efficient horse power.

Sec. 3—This act shall take effect immediately.

From this it will be seen that the commissioners may call upon the Niagara Falls Power Company to furnish electricity for light and power, also a water supply, at any time, but up to the present time they have steadily declined to do this. The Niagara Falls Power Company owns a controlling share in the Niagara Falls Water Works Company, the plant that supplies the south end of the city with water. The mains are connected with the State reservation, but the Niagara Falls Water Works Company has never rendered a bill for the service, simply stating that the water was being furnished under the above law. The current for lighting the reservation has been obtained from the Niagara Falls Hydraulic Power & Manufacturing Company, and for it $50 a month has been paid, but the new policy and the new commissioners will probably result in the State getting what the law says the Niagara Falls Power Company may furnish them. The Niagara Falls Power Company, it may be stated, have always been ready to fill their part of the agreement.

With the operation of the incline by electricity, several notable changes in the State property will no doubt be brought about. One of these is likely to be the razing of the stone building in which the office of the incline is located. This building stands a few hundred feet distant from the brink of the American Fall, and so far as beauty is concerned has no right there. The idea is to remove it and start the cars from an underground room, thus leaving the view of the falls unobstructed from the main portion of the park.

The incline has been in operation ever since 1844. Until 1873 it was operated through an open cut, but in that year a stone arch was built, the operating building was doubled in size and the frame structure over the tracks rebuilt. On March 9, 1893, an ice slide wrecked the lower waiting room, when it was rebuilt in the form shown in the illustration.

The Growth of Electric Power Transmission.

THE extent of the use of electricity as a motive power in the factory, shop, mill and mine, as well as in the transmission of power over long distances is hardly realized by those not directly brought into contact with the manufacturing side of the electrical industry. It is true that the daily papers and the technical press record, as far as possible, the applications of electricity which are constantly being made, but to gain a fair idea demands the exhibit of figures in the aggregate and a comparison between the feeble beginnings and the present strength of the electric power industry as it exists at present.

It is hardly more than seven years ago that special departments were tentatively established by electrical manufacturing companies for the purpose of essaying a new field—that of the application of electricity as a motive power in other directions than that of the street railway. Misgivings were many as to the success likely to accrue from the effort, but the widening use of the trolley and the electric light was pointed to by the believers in the necessity of electric power in the manufacturing industries, and predictions of ultimate success outweighed the incredulity of the less hopeful.

The history of the great effort put forth, the missionary work carried on, the constant succession of costly experiment and the lavish outpouring of electrical talent in the solution of the widely different problems as they arose, could it be written, would be fascinating reading in these more advanced days.

With direct current systems only to fall back upon, the propaganda did not meet with the encouragement expected. The limitation of distance in the possible transmission confined the use of the direct current within restricted bounds, and while the direct current motor was almost as perfect a machine as could be manufactured, it possessed certain shortcomings, which in cases rendered it unsuitable. The alternating current while it facilitated transmission, was weak in its motor side, and thus one system gave excellent generation and utilization, but poor transmission, while the other gave excellent generation and transmission, but poor utilization.

Digitized by Google

With the introduction of the multiphase system and the induction motor many of the major difficulties disappeared and for the first time was given to the world an ideal system of electrical generation, transmission and utilization. The field of electrical employ was immediately widened, while missionary work among manufacturers and others was shorn of many of the difficulties it had before encountered. Early in 1893, the first important multiphase transmission plant was installed and operated. Since that date multiphase installations have been made with constantly increasing rapidity, while the use of the direct current, or combinations of both direct and multiphase systems have also shown a gratifying growth. Starting with comparatively low voltages in generation and transmission, and short distances, both pressure and distances have been increased until to-day, even electricians most skilled in the art, hesitate to set limits to the use of any voltage however high, or transmission over any distance however great. It is the story of the gun and the armor. A gun built to pierce the thickest armor made is hardly tested before a plate is rolled to withstand any projectile it can fire; and this in turn is scarcely erected before a gun is constructed to readily penetrate it. As electrical pressures are increased so is the strength of the insulation to withstand them and the apparatus to transform, convert and utilize them. As the apparatus is perfected, and the factor of safety is increased, the popularity of electricity as a motive power becomes wider and wider, and while the rational being refrains from sanguine prophecy, the prediction of electricity as the universal motive power seems warranted if based on figures attainable to-day.

Access to figures to show the extraordinary growth is, however, not easy. The manufacturing companies do not willingly furnish statistics. We have, however, been able to secure from the power and mining department of the General Electric Company certain gross figures, upon which the total growth of the use of electricity as a motive power may be based.

The power and mining department was founded in 1889. Up to 1892 work was largely confined to missionary effort. In that year, however, power apparatus to the extent of 13,719 h. p. was installed. 1893 was the faint-hearted year, the year of the greatest business depression of the decade, yet the power apparatus sold amounted to 18,762 h. p., 5,043 h. p. more than was sold in the last year of the prosperous Harrison administration. In 1894 general business conditions showed some improvement, but only of a sickly character. This hardly seemed to affect the growing application of electric power, for in 1894 the business done amounted to almost 5,000 h. p. more than twice the business of 1893, or 42,379 h. p. During 1895, no striking increase over 1894 was made, but the standard set in that year was fully maintained, the aggregate horse power of the apparatus amounting to 46,727 h. p. In 1896 with the returning confidence of business a little ashamed of its susceptibility to scare, the use of electricity for power purposes made a great leap, the amount of apparatus sold attaining almost double of that placed in 1894 and 1895, four times that of 1893 and five times that of 1892. The total horse power sold in 1896 ran as high as 75,000 h. p. During

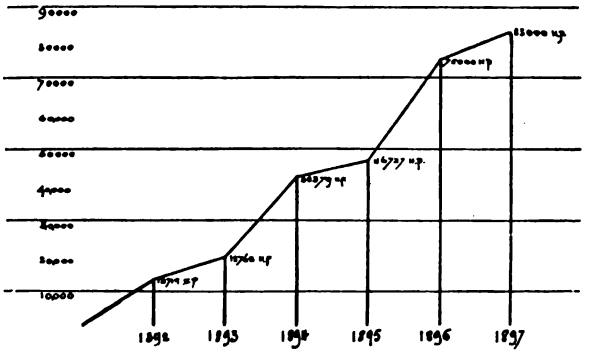


FIG. 1.

1897 no falling off in the demand for electrical apparatus occurred. Important power transmissions were completed, and the list of isolated mills and factories with drive changed from steam to electricity is of respectable length. The total horse power of the apparatus sold equaled 83,000 h. p.

These figures by no means represent the total horse power of the purely power apparatus sold by the General Electric Company. All small motor work, fan motors and such fall within the jurisdiction of the supply department, and were these added the total would be largely increased.

To realize more fully the very wide extension of the use of electrical apparatus, a better idea may perhaps be gained from the curves here shown. Fig. 1 shows the extent of the business each year; Fig. 2 shows the total growth since the beginning of

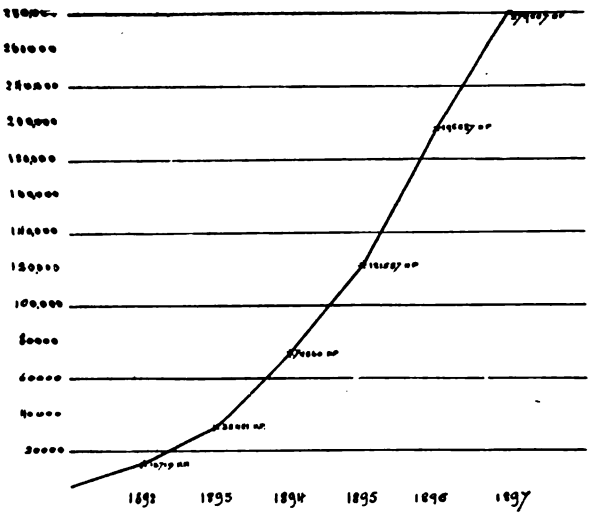


FIG. 2.

1892. By the end of January, 1897, the end of the company's fiscal year, it had attained the extraordinary total of 279,587 h. p. A fair harvest from small and hesitating beginnings!

If to this figure could be added the aggregate horse power of the apparatus manufactured and sold by the many other electrical companies in this country, the surprising total would readily warrant the assertion that the United States is well forward in its electrical age.

TELEPHONY AND TELEGRAPHY

The Novel Switchboard at the Harlem Exchange of the New York Telephone Company.

THERE has just been put in operation at the Harlem central office of the New York Telephone Company, situated at East 124th street and Lexington avenue, a new switchboard which is the ne plus ultra of telephone exchange equipment. The miniature incandescent lamp invaded the telephone exchange some time ago, but in the Harlem board it reigns supreme and signals each stage in a connection so distinctly that the operator's work is reduced to the simple operations of putting in the plugs ringing the called subscriber, and pulling the plugs out at the end of the conversation. The new board is a greater advance on the self-restoring drop system than was that on the old series multiple board.

The Harlem equipment, which was built and fitted up by the Western Electric Company, of Chicago, New York and the rest of the world, is known as the relay system, so called because the lamp signals are operated by relays. Some people call it the common battery system, because one of the fundamental improvements it introduces is the centralization at the exchange of the battery for energizing the subscribers' transmitters. The instruments at the subscribers' stations are materially simplified, the magneto generator for calling the exchange and the transmitter battery being entirely done away with. The new set consists of a call bell to attract the subscriber's attention, a transmitter, a receiver and an automattic switch hook for changing the line from the call-bell circuit to the talking circuit. When the subscriber lifts the receiver from the hook he signals

Digitized by Google

the exchange and switches his telephone in and the call-bell out in the usual manner. When he replaces the telephone on the hook he signals the exchange for disconnection and switches his telephone out and his call-bell in. All the operation required of the subscriber is the necessary and well established action of taking the receiver off the hook when he wants to talk, and the equally familiar one of putting it back when he has finished talking. The lamps at the exchange do the rest.

What happens to the ordinary connection at the switchboard is as follows: When the calling subscriber lifts the receiver off the hook a lamp set in the board just under the answering jack lights up. When the operator plugs into the answering jack to receive the call, the lamp is automatically extinguished. Having got the number, the operator taps the multiple jack of the line wanted, and finding it free plugs into it with the second plug. There is a disconnecting signal on each cord of the pair used in making a connection. These signals are lamps set in the keyboard, the two lamps being in line with the cords they control and with the listening key. The lighting of either lamp signifies that the telephone at the station of the line to which the cord is connected is on the hook. The lamp on the answering cord does not of course light up, as the calling subscriber necessarily has his telephone off the hook in order to make the call, but the lamp on the connecting cord lights up as soon as the plug is inserted in the multiple jack, and it remains alight until the called subscriber takes his telephone off the hook in response to the ring. The operator therefore knows, without listening in, when the called subscriber answers. As long as both subscribers have their receivers off the hooks, the two disconnection signals remain extinguished. If one subscriber hangs up, the lamp on the corresponding cord lights up, and the other subscriber may keep his disconnection signal extinguished by keeping his receiver off the hook, and so hold the wire. When both subscribers hang up, both lamps are lighted, thus giving an unmistakable disconnection signal. When the operator pulls out the two plugs to effect the disconnection, the two lamps are automatically extinguished. It will be seen that this system of signals gives the operator at a glance, without any necessity for supervision by listening in, full information as to the state of affairs at each subscriber's station.

The incoming trunk lines over which calls for Harlem subscribers are received from other exchanges in the system are each equipped with three lamp signals. These lamps are set in the keyboard in line between the cord in which the trunk line terminates and the ringing key. The lamp nearest the cord has a red globe and the other two are white. The red lamp shows when the called subscriber answers. The white light next to it shows when the operator at the originating exchange disconnects the trunk, and the second white light shows when the called subscriber hangs up his receiver. When a Harlem incoming trunk operator plugs into one of the mutiple jacks in front of her in response to an order sent over the call wire from one of the other exchanges, the red lamp corresponding to the cord used lights up and stays alight until the called subscriber answers. As soon as he takes the telephone off the hook the red lamp goes out; the trunk operator then knows that the connection is complete and rings no more. When the called subscriber hangs up, the white lamp nearest the ringing key lights up, and when the operator at the originating exchange clears the trunk, on receiving the ring-off of the calling subscriber, the middle white lamp lights. The lighting of the two white lamps is the disconnecting signal for the Harlem operator. The three signals give the incoming trunk operator a supervision of the state of affairs at each of the other two important points in the connection, the called subscriber's station and the originating exchange where the connection is made between the calling subscriber's line and the trunk line. She has a distinct signal informing her when her subscriber answers or hangs up and when the answering operator clears the trunk at the distant end.

The lamp signals afford the most perfect supervision of the progress of a connection and materially lighten the work of the operator. With proper co-operation on the part of the subscribers, the new system will materially quicken the service. For to any one watching the play of the lamps, with their little tell-tale glow marking clearly each step in a connection, it is obvious that of the total time occupied in getting two subscribers into communication a large proportion is that period between the first ring and the moment when the called subscriber takes his telephone off the hook to answer. It often seems that the lamp on the connecting cord glows an unconscionable time before the receiving station puts it out, and it is clear that subscribers have it easily in their power to raise the general efficiency of the service by smarter attention to their inward calls.

A useful feature of the new board from a management point of view is a pilot lamp on each section which lights up simultaneously with the line signal and remains alight until the plug inserted in the answering jack puts the line signal out. The pilot lamps show the manager of the exchange whether calls are answered quickly at all times and are an excellent aid to the general supervision of the work of the office.

Corpuscular Theory of Röntgen Rays.

THE most popular theory of cathode rays at the present moment is a corpuscular one, while the most popular theory of Röntgen rays is the undulatory or "hedge-firing" theory elaborated by J. J. Thomson and Johnstone Stoney. The Dutch physicists, Vosmaer and Ortt, recently proposed a tentative corpuscular theory of the Röntgen rays, which, however, was somewhat roughly handled on its appearance. Before seeing their paper B. Walter worked out a theory on very similar lines, which has a large number of considerations to recommend it, so much so, indeed, that its truth appears obvious and palpable at first sight. It consists in supposing that Röntgen rays are discharged cathode particles. It follows at once that they are not deflected by a magnet. After impinging upon the anti-cathode or other body and discharging themselves, the corpuscles are reflected in a diffuse manner and penetrate the walls of the tube. That they are able to do so is not surprising, considering that even the charged cathode particles are capable of penetrating a sheet of aluminum. Besides, since it is known that the ratio of the electric charge of a cathode particle to its mass is about 1,000 times that of the electrolytic charge of a hydrogen ion to its mass, it is evident that we have here to deal with particles much smaller than the electro-chemical ions. The only novelty lies in postulating the possibility of a divorce between the cathode particles and their charges. That Röntgen rays have a superior penetrating power is due to their electric neutrality. A copper bullet would have a greater chance of penetrating a forest of magnets than an iron bullet. The proportionality between absorption and the density of the absorbent is obvious. Ionisation of gases may be considered as a mechanical destruction of gaseous molecules by the impact of swift particles. When these particles are charged, like the cathode particles, the ionisation will be greater, as is indeed found to be the case. Porter's objection that the photographic activity of Röntgen rays is not affected by their transmission through a charged plate deserves consideration, but it is merely negative, and not in any way a crucial test.—Walter, Wied. Ann., No. 9, 1898.

Mutual Influence of Cathode Surfaces.

D. F. Tollenaer endeavors to explain all the phenomena observed by Wiedemann with regard to complex cathodes on the emission theory. Wiedemann introduces a new kind of horror vacui by his thesis that cathode rays are incapable of penetrating the dark cathode space of a neighboring cathode, and cites an experiment in which he mounted a card spread with chalk in the right angle between two cathodes in contact, thus obtaining two dark spaces showing a kind of mutual repulsion. Tollenaer traces out the probable paths of the cathode projectiles and shows that they do penetrate both dark spaces, but are deflected owing to a modification of the field by the vicinity of the other cathode.—Tollenaer, Wied. Ann., No. 9, 1898.

STEEL RAILS.—There is a report that an agreement has been reached among the manufacturers to put the price of steel rails to $20 a ton.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[*Entered as second-class matter at the New York Post Office, April 3, 1882.*]

Vol. XXVI. NEW YORK, NOVEMBER 24, 1898. No. 551.

Mr. Tesla to His Friends.

New York, Nov. 18, 1898.
46 and 48 East Houston St.

Editor of The Electrical Engineer, 120 Liberty St., New York City.

Sir—By publishing in your columns of Nov. 17 my recent contribution to the Electro-Therapeutic Society you have finally succeeded—after many vain attempts made during a number of years—in causing me a serious injury. It has cost me great pains to write that paper, and I have expected to see it appear among other dignified contributions of its kind, and, I confess, the wound is deep. But you will have no opportunity for inflicting a similar one, as I propose to take better care of my papers in the future. In what manner you have secured this one in advance of other electrical periodicals who had an equal right to the same, rests with the secretary of the society to explain.

Your editorial comment would not concern me in the least, were it not my duty to take note of it. On more than one occasion you have offended me, but in my qualities both as Christian and philosopher I have always forgiven you and only pitied you for your errors. This time, though, your offence is graver than the previous ones, for you have dared to cast a shadow on my honor.

No doubt you must have in your possession, from the illustrious men whom you quote, tangible proofs in support of your statement reflecting on my honesty. Being a bearer of great honors from a number of American universities, it is my duty, in view of the slur thus cast upon them, to exact from you that in your next issue you produce these, together with this letter, which in justice to myself, I am forwarding to other electrical journals. In the absence of such proofs, which would put me in the position to seek redress elsewhere, I require that, together with the preceding, you publish instead a complete and humble apology for your insulting remark which reflects on me as well as on those who honor me.

On this condition I will again forgive you; but I would advise you to limit yourself in your future attacks to statements for which you are not liable to be punished by law.

N. TESLA.

His Friends to Mr. Tesla.

ONE of the foremost electrical inventors of this country, whose name is known around the world, has been kind enough to say that The Electrical Engineer made Mr. Tesla. This is an attribution that we naturally put aside, for it is a man's own work that makes or unmakes him, but we do plead guilty to the fact that for these ten years past we have done whatever mortals could do to bring Mr. Tesla forward and secure for him the recognition that was duly his. Not only in the columns of this and other journals, but in magazines and books we have striven with all the ability we possessed to explain Mr. Tesla's ideas. The record is before all men. If there is a line or a word in it that seeks to do Mr. Tesla "serious injury," we demand its production by him. The man, whoever he be, who says we have ever in word or deed or thought tried to do Mr. Tesla any sort of injury, lies.

Within the last year or two Mr. Tesla has, it seems to us, gone far beyond the possible in the ideas he has put forth, and he has to-day behind him a long trail of beautiful but unfinished inventions. By mild criticism and milder banter, not being able to lend Mr. Tesla the cordial support of earlier years of real achievement, we have only very lately endeavored to express our doubts and to urge him to the completion of some one of the many desirable or novel things promised. We believe this to be true friendship.

For example, take Mr. Tesla's latest and furthest enlargement of his newest idea, as presented by him in a signed letter in the New York "Sun," of Nov. 21, unfolding his plan to dispense with artillery of the present type. At this moment we have space only for the following passage:

"We shall be able, availing ourselves of this advance, TO SEND A PROJECTILE, at much greater distance, IT WILL NOT BE LIMITED IN ANY WAY BY WEIGHT or amount of explosive charge, we shall be able to submerge it at command, TO ARREST IT IN ITS FLIGHT AND CALL IT BACK, and to send it out again and explode it at will, and, more than this, IT WILL NEVER MAKE A MISS."

When we are expected, wide awake and in our sober senses, to accept in silence such an utterance as that quoted above or that which describes as "a possibility" the operation of a distant torpedo boat by the mere exercise of the will, we refuse point blank and we are willing to face the consequences. Our past admiration of Mr. Tesla's real, tangible work is on record, and stands; but we draw the line at such things as these. We are sorry Mr. Tesla feels it so keenly, but we cannot help it.

Now, as to the specific points raised in the above letter, which Mr. Tesla certainly would not have written had he been well advised. As to the manner in which we came to print Mr. Tesla's paper, the two letters herewith speak for themselves.

The American Electro-Therapeutic Association.
Dr. Charles R. Dickson, Ex-President.
296 Sherbourne St.
Toronto, Canada, Sept. 26, 1898.

T. Commerford Martin, Esq., 120 Liberty St., New York.

Dear Sir—I was quite surprised to hear on Saturday last from my friend, Dr. Robert Newman, of New York, that the editors of The Electrical Engineer had received no notices of the meeting of our association; I understood that the secretary had sent them. However, in case you might find space to say something of us, I have patched up an article drawn from various sources giving full particulars, which you can cut down to the desired dimensions. I fully appreciate all that you have done for the association in the past, or would not go to this trouble. I also send you a copy of the programme and of hand-book. In regard to latter, I am very sorry that the Buffalo committee had to retain for such a long time the electro of Mr. Tesla which you were so kind as to loan to them through Dr. Newman.

Digitized by Google

I have to thank you very sincerely for the loan of the electro, and hope that it reached you in good condition.

Wishing your esteemed journal continued and increasing success, very truly yours. CHARLES R. DICKSON.

The American Electro-Therapeutic Association.
Dr. Robert Newman, Chairman.
64 West 36th St.
New York City, Oct. 20, 1898.

Messrs. T. C. Martin and J. Wetzler.

Messrs. Editors—We have now the necessary vote for you publishing Tesla's paper in The Electrical Engineer, you lending us the cuts in proper size for our transactions.

The pages of our book are 7½ by 5 inches—if our secretary is not dilatory, you will receive the mss. and illustrations at once. Will call soon. Yours most truly, ROBERT NEWMAN.

These show our relations with a deserving association and our efforts to assist its work. We may add as a matter of fact, for which, if necessary, the proofs will be presented, that before printing the paper, we sent Dr. Newman to technical publishers, who refused to print the matter in book form because there was not, in their estimation, sufficient demand for it among scientific men. Failing this, we were undoubtedly glad to give it a place in our pages, as it struck us as good "copy."

We venture also to direct attention to the dates of the Dickson and Newman letters, one Sept. 26 and the other Oct. 20. The Tesla paper was read on Sept. 15 and appeared in our columns Nov. 17. Does this gap of over two months between reading and publication justify Mr. Tesla's insinuation that we took swift and mean advantage of him and of our contemporaries? Will anyone produce a letter to show that anyone of our contemporaries ever took the slightest interest in the Tesla paper or even asked for it? If such letters exist, now is the time to produce them. The paper was given to The Electrical Engineer because this journal takes a deep interest in the advance of electro-therapists and has a wide circulation among them, and according to universal custom, the paper once read became the property of the association to deal with as it chose. That, without any particular effort, we should have secured a "scoop"—to use the slang of journalism—is nothing to be ashamed of; we rather glory in it, for whatever it is worth.

It will be noted that we placed freely at the disposal of the association a portrait block of Mr. Tesla which we value highly. We were anxious, however, to do him honor in this way, and loaned the original. Since that time, we have loaned it, without charge, to Mr. Belford, of "Success," in whose November issue it appears by our courtesy; and we have within the past week placed it at the disposal of another publishing house. Perhaps these are the attempts to do him an injury about which Mr. Tesla has so unfortunately allowed himself to be persuaded.

Now as to the very depreciatory quotations from the distinguished scientists, Profs. Brackett and Dolbear. The passage from Prof. Brackett appeared in the New York "Herald" of Nov. 9. That from Prof. Dolbear appeared in the New York "Herald" of Nov. 10. They had not been contradicted or withdrawn when we called attention to them and objected to them. One of our electrical contemporaries last week quoted them both like ourselves, but said it was inclined to agree with Prof. Dolbear. We now beg to call Mr. Tesla's attention to the subjoined dispatches from both scientists, and would say that having already expressed dissent from the views of both Profs. Brackett and Dolbear, we do not see how it concerns us any further.

(Press Telegram.)

Princeton, N. J., Nov. 20, 1898.

T. C. Martin, Editor of The Electrical Engineer, New York.

Some of the language on pages 490 and 491 of The Electrical Engineer of Nov. 17, purporting to be quoted from me, is a fairly correct reproduction of what I said to a "Herald" reporter in reply to his question as to the probable practicability of Mr. Tesla's device for the abolishing war already presented in the "Herald," a copy of which he showed me.

In the language which you quote, there is much confusion and inaccuracy, due to the fact that the reporter took no notes of what I said, but trusted his memory.

No subject other than that proposed, viz.: Is the proposed plan practicable, was discussed. C. F. BRACKETT.

North Cambridge, Mass., Nov. 21.

The Electrical Engineer, New York.

Letter received this morning. The "Herald" report was substantially accurate. I will write more to you presently.

A. E. DOLBEAR.

"Greatest Discovery of the Age."

Mr. H. W. Phillips, in the "Criterion" of Nov. 19, has an illustrated interview with Mr. Tesla, whom he quotes as follows in regard to his use of the coherer as a relay for steering dirigible torpedoes: "I think that it is the greatest discovery of the age. There is something artistic—an appeal to the imagination—in it that the telephone, phonograph and other fine inventions lack." In reply to an inquiry as to his ability to operate the coherer by an effort of the will merely, Mr. Tesla said to Mr. Phillips: "I have no evidence to support it, but I have a perfect right to state it—understand me—as a possibility—no more." Mr. Tesla also remarked: "Had I nothing else to show for a lifework, this would put the laurels of everlasting fame on my head."

The Evolution of the Surface Contact Railway.

THE sudden, swift and tremendous development of the open conduit railway system must have arrested the attention of every one who takes notice of electro-mechanical advance. Up to within the last year or two it seemed as though that method of traction would not operate successfully and economically in our American cities. Every trial resulted in utter failure in regard to convincing street railway managers that it was what they wanted. Now a change has come, and in New York nothing but the open conduit trolley has for the present the ghost of a chance; while many other cities bid fair soon to fall in line. Having fought hard for the overhead trolley, we can say that we welcome heartily this wonderful broadening out of the traction art, enabling electricity to capture the metropolis that was so long denied to it.

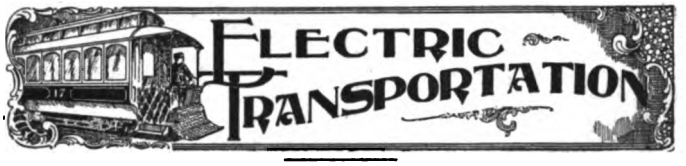
But is the end yet? Why need a conduit be open? Why must there be a couple of extra gutters in the street with bare exposed electrical conductors in them? We believe firmly that there is no final reason; but that the next step is some form of sealed conduit, or surface contact, system. Every indication points that way, and it is for this reason that we are glad to give space to the paper on this subject by Mr. E. H. Johnson, read last week before the New York Electrical Society. It must be remembered that he does not stand alone in his advocacy of the new departure. Both the Westinghouse and the General Electric companies have adopted sealed conduit systems, and reports of others come thickly from across the Atlantic. Such signs cannot well be mistaken.

As to the merits of the Johnson-Lundell system, it is hardly within our province to pronounce a judgment yet, but we wish it the fullest success. It has a great many good points, and it has behind it a man who despite the ardor of his enthusiasm has never yet backed a failure. Mr. Johnson ties to realities and builds up concrete successes, and it will be strange indeed if in the near future he does not see all his hopes as to surface contact railways realized to the fullest degree.

A New Electric Railway on Manhattan Island.

A certificate incorporating the Fort George Extension Railway Company, of New York City, with a capital of $10,000, was filed with the Secretary of State on Nov. 17. The company purposes to operate an electrical surface road from 172d to 185th street, on Eleventh avenue. Its directors are M. G. Starrett, W. P. Plummer, John Lambden, Andrew Loughlin, D. W. Patterson and Harry Hartwell, of New York City; John Kerr and Charles E. Corby, of Brooklyn, and H. A. Himely, of Far Rockaway.

Digitized by Google

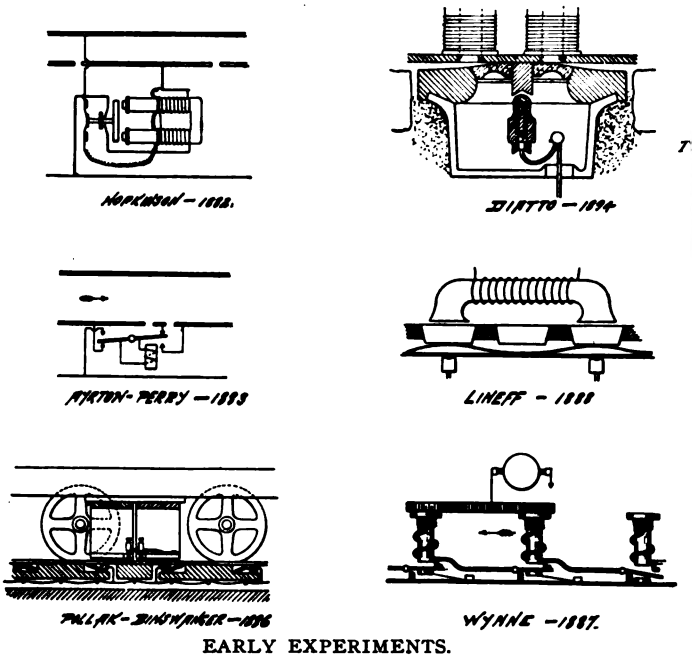


Surface Contact Electric Railways.—I.[1]

BY EDWARD H. JOHNSON.

IN considering the problem of electrically operated surface railways, as in considering other problems, one inventor will, from motives of expediency, follow the general trend of the commercial evolution of his art, while another will look beyond and seek that solution which shall possess the element of permanency by virtue of being founded on correct theory.

In no branch of modern electrical development has this divergence of inventive tendency been more marked than in that of electrical distribution for tram car service. The quick, cheap and effective overhead trolley afforded the "expediency" inventor a fruitful field. It was a rich harvest, but it was a harvest of one season only. That season has passed. The phenomenal success of the electric tram car has in itself forced a "public opinion" in antagonism to the overhead supply system, hence the "expediency" inventor is again requisitioned and following his nose with the instinct of his class, says "Take the trolley off the



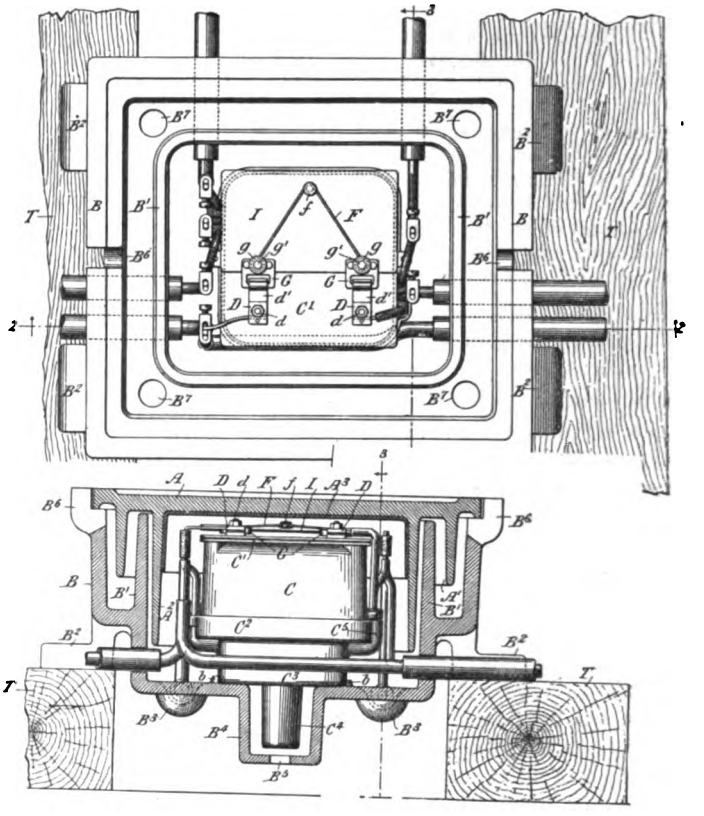
EARLY EXPERIMENTS.

poles and string it in a cable slot." The fact that electricity and water are mortal foes and that a cable conduit is nothing more or less than an open street sewer, has no weight with him, since his client's margin of earnings is sufficiently great to permit not only of enormous expenditure for a construction that will secure drainage but also for paying the considerable cost of the excessive leakage inherent in the system.

It thus comes to pass that in metropolitan streets, where the traffic is of "bonanza" proportions, the problem of complying with a public demand may be and is being met by a brute force solution—a solution in consonance neither with scientific nor with commercial principles.

That such a solution of the problem is no solution at all for at least 99 per cent. of the tramways of our American cities, can easily be demonstrated by a comparison of their possible net earnings and the interest on the great investment demanded by it.

A further development of the art is, therefore, essential, and the brother inventor must now, perforce, be granted a hearing. Of him is required a solution of the problem which shall possess the element of permanency and which shall yet not demand an investment of prohibitive proportions. Immediately this inventor opens with his plan, it is recognized as an old acquaintance, to whom not much attention has hitherto been paid and who has, in the whirl of expediency, been passed by with a gesture of impatience. Present necessity, however, now secures the recognition heretofore denied, and lo! it is discovered that not only is



FIGS. 1 AND 2.

the plan a true solution but that it was, as a matter of fact, evolved fundamentally from the brain of the late and lamented Dr. Hopkinson 16 years ago, and it is safe to say that had it met with a tithe of the encouragement given to its overhead and open conduit brothers, it would have been more speedily perfected, and neither the overhead nor the underground trolley

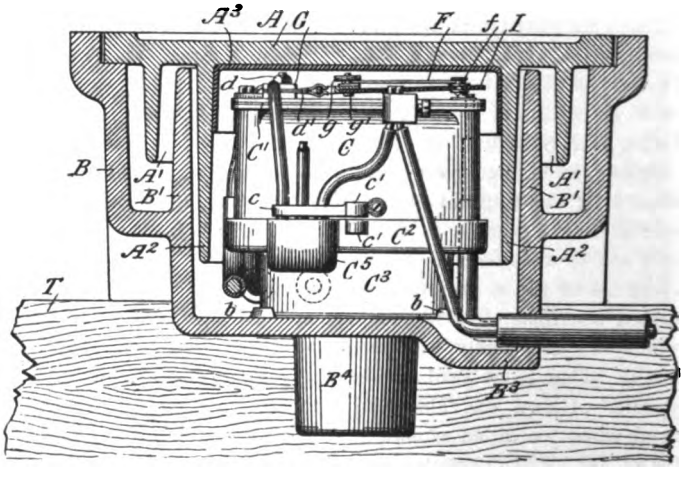


FIG. 3.

would to-day exist upon a single important street in either city or town.

An important factor effective in retarding the development of a sound system has been the unwillingness of the larger street railway syndicates to see any underground system a demonstrated success. Their overhead charter rights generally contain an obligation to substitute such a system on proof of its practicability, hence their determination to damn it in the eyes of the public and municipal authority. Even yet the corporations owning franchises, while suffering their associates to develop the costly open conduit in the great and wealthy metropolis, having no fear of its being forced upon their less prosperous lines in minor cities, assume a position of determined hostility toward

[1]Read before the N. Y. Elec. Society, Nov. 16, 1898, at the College of the City of New York.

Digitized by Google

the cheaper and superior system, knowing full well that a single demonstration of its practicability in New York would promptly compel its general adoption in Philadelphia, Boston, Chicago and elsewhere.

THE PERMANENT SOLUTION.

The "Surface Contact System," as its name implies, delivers the current to the moving car by virtue of contact between a bar or "skate" carried by the car and sectional conducting metals fixed in the surface of the roadway. The mere statement of the general conditions suggests as an essential requisite that the current shall be there for the car only, and not for the horse or other street user. This in turn implies the automatic charging of the surface contact points when needed by the car and their automatic discharge when the car has passed, by means of some force associated with the car itself, and since we are dealing with currents of many horse power, it follows that the individual factors in this automatic operation must be absolutely reliable. In fact, the devices employed for the discharge of the current at least must be infallible. Nothing less will avail, since there can be no divided responsibility for accidents resulting from the use of such a system. A live section is as innocent looking as a dead one. It gives no notice to the street user and hence he is not charged with the responsibility of avoiding it. Under these circumstances, the law would promptly condemn the system and compel its abandonment upon its first offence.

One deterring force of substantial weight which has operated to keep this system in the background, is the common impression that these automatic factors could not be so designed as to at all times possess this property of infallibility. Mr. Lundell and I have, however, held to the contrary, and after more than three years of almost continuous experimental work and practical demonstration are now able to challenge those who hold otherwise to place their finger upon a weakness in the system which, if accidentally developed, would result in a dangerous electrification of the street.

The history of the origin and evolution of the surface contact idea is too varied and voluminous to be recounted in a brief paper, but I have prepared a few illustrations of the most ambitious efforts that have been made from Dr. Hopkinson down to our own, and will note briefly their salient features.

Dr. Hopkinson, 1882, the originator of the idea of surface contact, had only in mind the prevention of heavy leakage from a commercial point of view and not at all as a matter of securing safety. Hence, his electrical connections were not designed and could not be considered for a moment as factors of safety. He simply overlooked the point of vital importance.

Ayrton & Perry, 1883, simply diversified the electrical connections in many ways, but clearly with only the Hopkinson end in view. Their system was thus, not superior to Hopkinson's, and therefore no better adapted to secure safety.

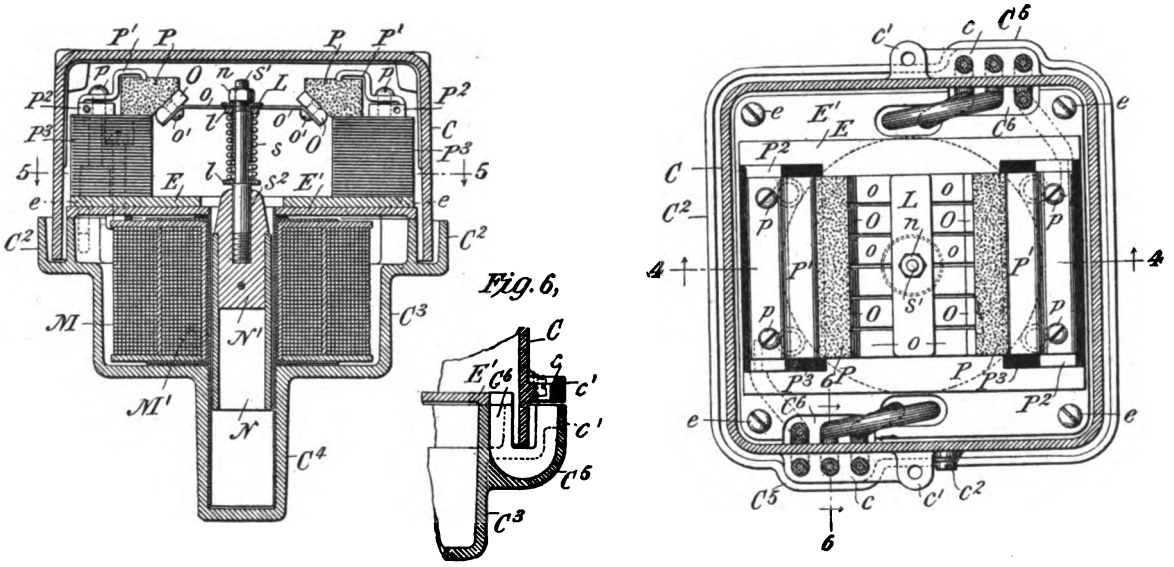
Pollock & Binswanger, 1886, were among the first to recognize the importance of safeguarding the street and they adopted the idea of operating switches in the street by electro-magnetism developed on the moving car. They have had many followers, among whom may be mentioned Wynne, 1887; Lineff, 1888, and Diato, 1894.

The principle has, however, been found inadequate because unreliable at high speeds, a fact readily comprehended by those who understand the laws governing magnetism.

The latest candidate for honors in surface contact development is Prof. Sylvanus P. Thompson, who endeavors to combine the good points of the electro-magnetic switch system with the good elements of the pure "magnetic pick-up" system. The result is, however, not a happy one, as it involves the switch in complication, whereas, as every engineer and mechanic knows, an essential condition of infallibly operative mechanism is that it shall be reduced to the last stage of simplicity, viz., a weight falling in free air.

As these multifarious steps in the evolution of the art have been taken, it has become more and more apparent that the positive acting electro-magnetic switch energized directly by an ample electric current and possessing, as it does, the quintessence of mechanical and electrical strength and simplicity will alone yield the positive and reliable results demanded in railway work.

Moreover, as it has been found that a certain "time allowance" for the operation of the switches is essential for high-speed work, a duty requiring the switch to operate before it is reached by the contact shoe of the car, it is, of course, apparent that since the electro-magnetic switch is the sole device capable of responding at a distance, it alone is equal to such duty.



FIGS. 4 AND 5.

Mr. Lundell and I have from the outset recognized these severely exacting conditions, and have, accordingly, based our work entirely upon the electro-magnetic switch and sought to reduce it to the acme of simplicity and consequent reliability, as well as to evolve a system of circuit connections equal to every requirement of speed, direction, capacity, economy, reliability and safety. These results we not only claim to have achieved, but, in doing so, to have produced a system so inexpensive as to justify its adoption wherever the overhead trolley is now financially successful.

THE SWITCH.

Fig. 1 is a plain view of the switch box in its position in the roadbed with the cover removed so as to show the internal structure thereof (the line 2 2 being parallel with the roadway).

Fig. 2 is a sectional view taken on the line 2 2, Fig. 1.

Fig. 3 is a transverse sectional view on the line 3 3, Fig. 1.

Fig. 4 is a vertical sectional view taken through the body of the switch-inclosing box on the line 4 4 of Fig. 5, which latter figure is, in turn, a horizontal sectional view of the same switch-inclosing box taken upon the line 5 5 of Fig. 4.

Referring to the drawings in detail, and first to Figs. 1, 2 and 3, B represents a cast-iron protecting box of rectangular form and provided with four legs, $B^2B^2B^2$, adapted to sustain the box in position between two ordinary crossties, T T. This box is cast in one piece with an upwardly extending inner flange, B^3,

Digitized by Google

running entirely around the interior of the box and adapted to form with the top or interior flange, B^4, a deep-seated groove, which we may call a mud groove.

A represents the cover of the box, which is also of cast-iron, and is provided with two downwardly extending flanges, A^1 A^2, the flange A^1 being adapted to extend a considerable distance into the mud groove, as will be seen on examination of Fig. 2.

The flange A^2 is somewhat longer than A^1 and extends to a point near the bottom of the box B, forming a sort of a dividing bell for the protection of the fuse block and terminals shown in the figures referred to.

The inner surface of the cover or lid A is lined with insulating material for the purpose of preventing any possibility of the continuance of an arc when the fuse, which is shown in Fig. 1, blows.

The switch inclosing box proper (see Figs. 4 and 5) is composed of two cup-shaped parts, C and C^3, the lower part, C^3, being provided with an upper grooved extension, C^2, and a lower cylindrical extension, C^4, the arrangement being such that the lower edge of the upper portion, C, of the inclosing box will fit within the grooved portion, C^2. The lower portion, C^3, constitutes not only a part of the inclosing box, but is also adapted to act mechanically as a part of the magnetic circuit of the electromagnetic switch, E^1, being a cast or wrought iron plate with an opening in its centre and held by small screws, e e e, to the upper face of the inner part of the grooved portion, C^2.

The lower part, C^3, of the inclosing box constitutes a chamber for the switch operating magnet, which is of solenoid form and is provided with two windings, M and M^1, the circuit connections for which will be described later.

N is a hollow solenoid core of soft iron secured to an insulating standard, N^1, which, in turn, is secured by a rod, S^2, to a series of yielding conducting arms, o o o, having secured to their outer ends a series of good metallic conductors, o o o, the whole arrangement being such that when the solenoid core is in its lower position the metal contacts, o o, will rest on the upper surface of the insulating plate, E.

P^3 are blocks of insulating material, preferably slate and P^2, are blocks of conducting material secured to the same.

P^1 are clamps for holding bevelled-shape blocks of carbon, P P, in position, the arrangement being such that when the solenoid core, N, is held in its upper position under the influence of an energizing current, the working current will pass from the conductor joining one of the carbon blocks P to and through the contacts o o o, arms o o, and other contacts o o o, to the remaining carbon block P, and thence to the exposed sectional trolley conductor embedded in the roadbed in the manner well understood.

All of the parts of the switching mechanism are properly assembled in the workshop and placed in position in the inclosing switch box C.

The cables leading to the switch boxes and to the ends of the magnet coils are bent downward in the side box C^5, as shown, and the cover C is placed thereon with its lower edge resting in the groove C^2 after which this groove is filled with paraffine or any preferred sealing material, thus assuring the fact that all of the operative parts of the switch will be protected at all times and ready for use when they arrive at their destination, where they may be placed in the outer box B^4 after the manner shown in Fig. 2, and the necessary connections made between the several conducting cables.

Financial Condition of Connecticut Trolley Roads.

The returns to the State Railroad Commission of the trolley railroad companies in Connecticut, while covering this year a period of only nine months as compared with a year in the preceding report of the commission, indicate, on the basis of the nine months' earnings but a very slight increase in gross earnings as compared with last year, and a slight decrease in the net, notwithstanding the opening of one new line and a considerable number of extensions of old ones. Out of twenty-seven independent corporations only ten paid dividends, suggesting the heavy burden of the bonded debt from which so many Connecticut trolley roads have been built and equipped. Stock issued is approximately $10,151,040, as compared with $9,770,440 last year, and outstanding bonds are approximately $11,311,800, as compared with $9,092,800 last year. The floating debt, decreased to about $732,000, as compared with $1,071,421 last year.

The Trolley Special of the Richmond Commuters.

LATE every afternoon the surging crowd at this end of the New York and Brooklyn Bridge, says the New York "Evening Post," surrounds each trolley car as it arrives, and struggles for places, rendering the alighting of the passengers a feat of strength—but all who have had occasion to cross the bridge at that time have witnessed and participated in the battle. Perhaps they have seen standing off at a little distance a party of fifteen or twenty men, cool, cheerful, free from anxiety, but also evidently waiting. Very punctually at five there arrives a parlor car. The crowd makes for it, but hesitates upon seeing its character. Those who are bold enough to think its comfort free to the first-comer find its gates closed and a guard standing there to warn the climbers off with the cry that it is a private car. Then the gates are cautiously unclosed to the party of fifteen or twenty just mentioned, who, taking advantage of the falling back of the crowd, enter without difficulty. The gates are quickly shut again, and the car whirls off. There are envious glances after the retreating car, as its favored occupants are seen throwing off their coats and dropping into large, soft revolving chairs, chatting in high good humor and laughing, with satisfied faces, strongly contrasting with the gloomy countenances of the crowd behind which must fight for seats, and, if defeated, must stand in a car which is going to be, in either case, crowded, draughty, and unwholesome to breathe in.

This parlor car is one of the three belonging to the Brooklyn Heights Street Railway Company, and for the last four or five months has every morning brought this same party from their homes at Richmond Hill to Manhattan, and taken them back every afternoon. It is chartered by them, and is exclusively theirs for these trips. They were formerly commuters of the Long Island Railway. They walked or rode to the railway station at Richmond Hill distances which varied, but in some cases were unpleasantly long. They followed on the train anything but an air line to the Long Island Railway ferry opposite Thirty-fourth street, where they were compelled to alight and take a ferryboat. A ride of several miles then landed them at the foot of Roosevelt street, where the belt line, after its fashion, which everybody knows, availed some of them, the rest being obliged to walk to their places of business. From terminus to terminus the trip consumed about sixty-five minutes.

Seasoned commuters though they were, they rebelled in time against this rather barbarous fashion of getting to business, and they began to consider ways and means of escape. It seemed at first a mere waste of thought, and some of them, it is understood, contemplated giving up their homes in Richmond Hill. At last, however, one of the party had an idea. He had read about the parlor cars of the Brooklyn Heights Street Railway Company, and that they were chartered for special occasions, and he wondered what there was to prevent a contract with the company for the daily use of one of them to and from Richmond Hill. The idea, being broached to the rest of the party—a coterie of acquaintance and friends—met with an enthusiastic reception, and a committee was authorized to wait on the management of the company and find out how feasible was the project. They discovered to their delight that it was perfectly practicable from the company's point of view, and that the cost was far from prohibitive. They closed a contract at once, and ever since have been among the happiest of men so far as the removal of a serious inconvenience and the solving of a vexing problem can make men happy.

Whether they save money by their contract could not be ascertained, because the company regards the price as a private matter. But they certainly save everything else. They save ten minutes each way, twenty minutes a day, the trolley car making a trip in fifty-five minutes. It lands them where most of those who have to walk have a shorter distance to go, and where there are greater facilities for further riding. It saves them all change of vehicle—no more climbing out of the train and hustling for the ferryboat—very unpleasant in bad weather, especially bad winter weather. But this by no means exhausts the list of advantages. The car is a delight to travel in.

There are the twenty large, luxuriously upholstered revolving chairs. There is plenty of daylight during the morning, and in the dusk and darkness falling between 5 o'clock and the arrival at Richmond Hill there is brilliant electric light. There is a handsome and commodious buffet in the car, which is stocked with light refreshments, cigars, cards, and backgammon, draught, and chess outfits. There is no crowding, for there are only

Digitized by Google

twenty to ride in the car, and each has his own seat. The air, when the weather necessitates closing the car, is good. Heat in cold weather is ample. There is no stopping, except for obstructions in the way—none for other people to get in and stand in one's light and on one's toes. It is a strict express, halting only to let its occupants alight at their destinations—in most cases at their very doors. The party is identical every day, and is made up of men who have mutually associated themselves, and are on the most genial terms. It is, in fact, a small club—a trolley club, it might be called, which has two agreeable meetings every day. They make merry when they meet, and the ride each way is one of the pleasantest incidents of the day, instead of the misery it frequently was under the former conditions of their travel. Instead of waiting to get home to rest, they begin resting as soon as they get in the car. Coats are thrown off, the buffet is opened, the inner man receives edification, the cigars are passed around, the games come forth, the books and newspapers find circulation. From start to finish no outsider interferes with their quiet, comfort, and enjoyment. They reach home renovated men, whom their wives and children welcome without pity or nervous apprehension. In short, the scheme proved "a grand success."

MISCELLANEOUS

High Voltage Power Transmission.—I.[1]

BY CHAS. F. SCOTT.

OBJECT OF INVESTIGATION.

SEVERAL years ago an investigation of the conditions and requirements incident to the use of high voltages was undertaken by the engineering department of the Westinghouse Electric & Manufacturing Company. In this experimental investigation the size of the apparatus and the conditions of the tests were as far as practicable such as would prevail in actual work.

The transformer, the sine qua non of high-voltage working, received first consideration. A design suitable for large sizes was worked out and tested; then high-voltage windings were made. Attention was next directed to the line insulator. New forms and sizes were designed, made and tested to determine the losses which would occur and the limit at which they would break down.

The luminosity and the hissing sound emitted by the connecting wires of high voltage, suggested a loss which might be an appreciable addition to that over the surface of the insulators. It was found that a very considerable loss of energy took place between the wires—a loss which at high voltages was much in excess of that across the surface of the insulators.

The tests, the author states, were undertaken at Telluride conjointly with Mr. L. L. Nunn, a pioneer in power transmission work, and the results of the work at this place were so assuring that the Telluride Power Transmission Company has lately installed a plant which is in commercial operation at 40,000 volts, and is now making an increase in the plant.

HIGH TENSION TRANSFORMERS.

In 1891 the Westinghouse Company furnished transformers for the 10,000-volt transmission to San Bernardino and Pomona. Twenty transformers were used in a set, each giving a pressure of 500 volts and the twenty in series 10,000 volts. This arrangement made the insulation within the individual coils a matter of comparative ease. The insulation between the coils of the high-tension circuit and other parts of the transformer was secured by allowing a space which was filled with oil.

The first arrangement of transformers for giving from 30,000 to 50,000 volts was made by using a number of transformers, each giving 10,000 or 15,000 volts. A large transformer was designed in January, 1894. The output of 200 k. w. was many times greater than that of any transformers which had been made by the Westinghouse Company. The transformer was oil-insulated and was cooled by water flowing through a pipe immersed in the oil. This transformer was pronounced a success, and the type was adopted and has been followed ever since as a standard, except that the water-cooling is employed only on the largest sizes.

The transformer was then rewound for 40,000 volts, and a somewhat reduced output. It was operated at this voltage for a short time, when it was found that through an oversight, the insulation between layers was insufficient. In October the high-tension coils were rewound for 60,000 volts and the transformer is still in use after many months of varied service and a considerable period of inactivity.

HIGH TENTION INSULATORS.

After a high-voltage transformer was constructed, the insulator naturally presented itself as a fundamental factor in transmission. The requisites of an insulator for high-voltage work are, that it shall have a dielectric strength sufficient to prevent the current passing directly through the material, that its dimensions shall be large enough to prevent the passage of current over the outside of the insulator to its support, and that the resistance, both of the material and its surface, shall be sufficiently high to prevent undue loss of energy. In addition to these fundamental electrical requirements are those of a mechanical nature involving strength and convenience. These properties must of course be permanent, and not liable to deterioration while in service.

A much larger glass insulator was made having the so-called "helmet" form, which was probably the beginning of a type which is now quite common. The large glass insulator presented mechanical difficulties in manufacture and recourse was had to porcelain.

An interesting evolution then began to take place in the manufacture of porcelain. There were eight or ten steps in this history, in which insulators which were presumed by the manufacturer to be satisfactory were broken down on high-voltage test. Porcelain which presented a beautiful smooth glazed surface was often found to contain internal cracks or cavities which were soon traversed by the current. In other cases bits of pebbles or other impurities were found. In still other cases the porcelain was not homogeneous and was not compact, or the material was porous and absorbed a drop of ink almost as readily as a lump of sugar would do.

The under-hung form of porcelain insulator, the first form employed, did not prove successful nor satisfactory. The insulator was heavy and cumbersome, and no satisfactory method was devised for holding the wire.

Some measurements were made of the losses on the Pomona 10,000-volt transmission line insulators. Twenty-four insulators were mounted on wooden pins. A wire was run along the tops of the insulators and a second wire connected the pins. The increase produced in the reading of a wattmeter in the primary of the raising transformer when the wires were connected to the high-voltage terminals, was taken as the loss on the insulators. The loss at 25,000 volts was about two watts per insulator. This voltage between pin and wire corresponds to 50,000 volts between transmission wires.

LOSSES BETWEEN WIRES.

The loss over the surface of insulators was quite small, in fact almost insignificant compared with the amount of power which would ordinarily be transmitted. The various displays of energy about high-tension wires, led us to investigate and determine whether this loss was one of importance. In order to measure the loss between wires, eliminating what occurs on the insulators, it was desirable to have a considerable length of wire, to support it without insulators, and preferably to arrange the wires in such a form as to give a considerable loss. Nine wires each 60 feet long were stretched 4 inches apart in a horizontal plane and were held in place by strings several feet in length at each end. The wires were No. 19 B. and S. gauge, 0.036 inch in diameter. They could be connected in various ways, and any pair or pairs of wires could be omitted as desired.

The wires began to give a hissing or crackling sound and in the dark began to appear luminous at a little below 20,000 volts. As the voltage was increased the sound became more and more intense, the wires vibrated and became more and more luminous, until at the higher voltages they were surrounded by a coating of soft blue light many times the diameter of the wire. Often there were bright points along the wire, probably corresponding to bits of dust or rough places resembling points on the wire. The large room soon became strongly charged with ozone.

The results of the measurements which are presented by the author in the form of curves, show that while the loss in the

[1]Abstract of a paper read before the 15th general meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

transformer is less at the higher frequency the loss on the high-tension wires is almost the same for both frequencies, namely, 60 and 133 periods per second. These losses are very small below 18,000 volts, but increase rapidly up to 30,000 volts, which is about the highest pressure used.

Measurements made upon wires at greater distances show that the action is considerably less as the wires are separated. The loss is approximately the same at 28,000 volts when the wires are 4 inches apart that it is at 36,000 volts when they are 16 inches apart. The loss for a distance of 8 inches is intermediate.

Other measurements were made, but nothing of further importance was developed. It is interesting to note that within a few days of the first measurements the general characteristics of this loss were determined, namely, that the loss between wires increases rapidly after a critical voltage is reached, that the loss is practically independent of the frequency, that it is much less as the distance between wires is increased. When a loss of 1,200 watts was obtained on a total length of 540 feet of wire at only 30,000 volts, the important bearing of this phenomenon upon transmission became very evident. The tests were stopped as preparations were begun for the continuation of the work at Telluride.

TRANSFORMERS AT TELLURIDE.

The original Telluride plants operated at 3,000 volts. Both the generator and the synchronous motor were wound for this pressure. Two transformers were furnished for the high-voltage tests, one for raising the generator voltage for transmission and the other for lowering the voltage for the motor. The windings were connected with a number of terminals by which the high-tension voltage could be varied over a wide range up to 60,000 volts.

Coils of similar shape were placed side by side in what is known as the "parallel" form of construction. Each coil had many layers of wire and but few turns per layer, thus securing a small difference of pressure between consecutive layers. The high-tension winding was divided into four similar coils, each designed to give a maximum of 15,000 volts. The individual coils could be differently connected, either in series or in multiple. The low-tension coils were five in number and were provided with loops, by which the number of effective turns could be varied. Three low-tension coils were placed between two pairs of high-tension coils and the two remaining low-tension coils were placed on the two ends. Between the low-tension and high-tension coils metallic shields were placed, which were connected to the ground for protecting the low-tension circuit from danger in case of accidental contact with the high-tension circuit and also for screening the low-tension circuit from electrostatic induction from the high-tension windings. The transformer was immersed in a case containing oil. The iron and the case of the transformer as well as the shields between the coils were connected to the ground.

There was also an auxiliary transformer whose primary was connected across the generator terminals while its secondary was placed in series with the circuit to the raising transformer, thus either raising or lowering the generator e. m. f. as desired. The secondary had a number of steps so that the voltage could be varied at will.

THE TRANSMISSION LINE.

The line extends from the power station near Ames, which is a few miles from Telluride, Col., to the Gold King mill. The line passes over an exceedingly rugged country and has a total length of nearly 2¼ miles (11,720 feet). There are 62 poles, each carrying three cross-arms, the upper being about 26 feet from the ground. Each cross-arm carries two wires supported by insulators which are designated as follows: Large glass, small glass, porcelain. The large glass insulator is the same as that used on the circuit in the San Bernardino and Pomona plant. The total height is 5 inches and the maximum diameter 5½ inches. The bottom of the insulator stands 1¼ inches above the cross-arm. The porcelain insulator is 4 1-16 inches high and 5⅞ inches in diameter. The bottom is 3 1-16 inches above the cross-arm. The small glass insulator is 3½ inches in height, 4¼ inches in diameter and stands 2¼ inches above the cross-arm. This insulator is triple petticoat; the other two insulators are double petticoat. The circuits were strung with galvanized iron wire 0.165 inches in diameter, which is No. 8 B. W. G., and about No. 6 B. and S. gauge. Later the circuit on porcelain insulators was changed to No. 6 B. and S. copper wire 0.162 inches in diameter. The measured resistance of one of the iron wire circuits was 66.25 ohms at —7 deg. C.

THE LIGHTNING PROTECTION.

The lightning protection was laid out by Mr. A. J. Wurts, who previous to this time had spent some months at Telluride, determining the requirements for protecting the 3,000-volt circuit. The protection consists of choke-coils and spark-gaps of non-arcing metal, as described by Mr. Wurts in his paper before the Institute, March, 1892.

In each line ten choke-coils were placed. Unit arresters were used each consisting of seven non-arcing metal cylinders and having six spark-gaps.

The author then describes the tests made at Telluride and gives a discussion of the results as well as a general résumé and conclusions. These will be reproduced in our next issue.

The Patent and Trademark Revision Committee.

DURING the past week, a meeting has been held in this city of the Patent and Trademark Revision Committee, and a final, third meeting takes place this week in Washington. The first meeting was held in Chicago on Oct. 8, being a conference of those interested. The commission is to send in its report to Congress in December.

A commission, consisting of Peter S. Grosscup of Chicago, United States District Judge for the Northern District of Illinois; Francis Forbes of New York, Secretary of the United States Trademark Association, and Arthur P. Greeley of Washington, Assistant Commissioner of Patents, was appointed by President McKinley under the provisions of an act of Congress approved on June 4, "to revise and amend the laws of the United States concerning patents, trade and other marks, and trade or commercial names, which shall be in force at the time such commission shall make its final report, so far as the same relates to matters contained in or affected by the convention for the protection of industrial property concluded at Paris, March 20, 1883, the agreements under said convention concluded at Madrid April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels, 1897, and the treaties of the United States, and the laws of other nations relating to patents, trade and other marks, and trade or commercial names."

The first meeting of the commission was held in Chicago on Oct. 8, when a conference was held with representative inventors, manufacturers and patent lawyers, with a view of outlining the policy of the movement and the plan of investigation. The next meeting will be held in New York on Nov. 19, and the final conference will take place in Washington on Nov. 22. The commission has been instructed to present its report to Congress in December.

The convention concluded at Paris on March 20, 1883, was the result of the formation of the International Union for the Protection of Industrial Property, in which the governments of Belgium, Brazil, Spain, France, Guatemala, Italy, the Netherlands, Portugal, Salvador, Servia, and Switzerland participated. In 1887 the United States joined this union and the following named countries have since signified their adhesion to the convention: Denmark with the Faroe Islands, San Domingo, Great Britain with New Zealand and Queensland, Norway, Sweden, and Tunis. Austria-Hungary gave notice of adhesion in 1897 with the reservation of legislative ratification, and Salvador withdrew on Sept. 6, 1886.

Although this convention is in effect an international treaty, its provisions have not been enforced by statute in this country. American inventors enjoy privileges which are denied to foreigners in the Patent Office, namely, the right of filing caveats and the establishment of priority by proving the date of invention or when first disclosed to others. The right of priority accorded to a foreign inventor under the American patent laws begins not with the date at which he actually made the invention or with the date at which he first filed an application for patent for the invention in any country, but with the date at which the invention or description of it was made known in this country. With American inventors right of priority begins with the date at which the invention was made and disclosed to others.

Another important matter that will come before the commission and probably form the subject of an urgent recommendation is the proposed modification of the feature of the convention relating to "delay of priority." At the present time the

Digitized by Google

practice of most foreign countries does not admit or provide for modification of original applications, and, as the convention requires inventors to file an exact copy of the application for patent in their own country with each foreign Government, American inventors often find themselves applying for patents in foreign countries on features of an invention that have been declared not patentable in this country. To make the convention of practical value to American inventors, provision must be made for filing copies of amended applications instead of the original petition. This feature is of value as it would extend the time in which inventors could determine whether patents are desirable in foreign countries.

It is contended that the laws of the United States relating to trademarks need general revision. In the first place, only trademarks used in foreign countries can be registered, and restrictions are made denying the use of regional or territorial titles or family names. But the principal complaint is based upon the fact that American manufacturers are obliged to submit to the expense, inconvenience and delay occasioned by individual and separate registration in foreign countries, although this country is extending to citizens of other nations all the rights and privileges secured by the Union for the International Registration of Trademarks. This organization was founded at Madrid in 1890 and resulted in the adoption of an agreement on April 14 of that year by Belgium, Brazil, France, the Netherlands, Portugal, Spain, Switzerland, and Tunis. Austria-Hungary has also adhered provisionally, but the United States did not sign the agreement, and as a result American manufacturers who desire to extend their business in foreign lands are at a great disadvantage. An arrangement between Great Britain, Spain, France, Switzerland and Tunis was made at the same time to prevent false identification of the origin of goods.

It is urged that the United States should immediately join in these agreements. The advantages of the Union for International Registration of Trademarks are secured through the Bureau at Berne, which upon notification by a member of the union simultaneously registers trademarks in all the countries included in the agreement. A fee of $20 is charged for this service by the bureau, and the applicant has immediate protection and saves all the annoyance and expense that are entailed by personal application for registration. An effort will be made to secure the universal adoption of an agreement that will embody a uniform law for the protection of owners of trademarks in the use of their property. At present counterfeits are often registered in countries where protection is given to the first applicant. This often results in great hardships, as in most countries the use of a trademark by a person not legally authorized to affix it is punishable by confiscation of the goods.

Instructions for Testing Transformers.

THE more extensive introduction within recent years of the alternating current transformer, and the resulting necessity of entrusting its care to a large number of men lacking theoretical knowledge, have induced various companies selling and installing these appliances to issue instructions for testing and caring for transformers. Such instructions have recently been issued by the Moloney Electric Company, St. Louis, Mo., and being stated in simple and concise language, they must certainly prove of great value to a large number in need of such instructions, and are therefore printed and illustrated below.

Drop.—To test a transformer for "drop," connect as in Fig. 1.

AA represents supply current of sufficient capacity to carry full load on transformer to be tested. BB switch on supply line. C volt meter connected to secondary of transformer to be tested. DD secondary of transformer to be tested. D'D' primary of transformer to be tested. FFF & C & C ten 100 volt lamps in series. E switch connecting lamps to primary of transformer to be tested. GG primary of volt meter transformer. G'G' secondary of volt meter transformer. H volt meter.

Having made the connections as indicated above, close switch BB leaving switch E open, and note the reading on volt meter C and on H. (These readings should be identical, although this is not essentially necessary, as only a ratio of meter readings is required for an accurate test.) Now close switch E and observe readings of meters C and H. The difference between the first readings and the second will show the drop in voltage; for example, if after closing switch BB, C reads 103 volts and H 102, which on closing switch E will vary to C 102 and H 99 volts, we are to understand that the drop in the transformer is of 2 volts. This drop we deduce as follows: In the first readings H showed 1 volt less than C, while in the second H reads 3 volts less than C, or two volts less than in the first readings.

Total drop on H:

First reading	102 volts.
Second reading	99 volts.
Difference	3 volts.
Deduct drop due to supply shown on C	1 volt.
Total drop	2 volts.

Copper Loss.—To make the test of "copper or C^2R losses," connect as per Fig. 2.

AA is supply line of 100 to 200 volts (100 if the secondary is of 50 volts and 200 if it is of 100 volts). B variable resistance. W wattmeter of approved pattern. DD primary of transformer. D'D' secondary of transformer. E ampere meter of approved pattern.

After making the connections indicated above, vary the resistance until the current shown on meter E is equal to that for which the transformer was built. On a ten-light 100 volt secondary this would be amperes. Observe carefully the reading

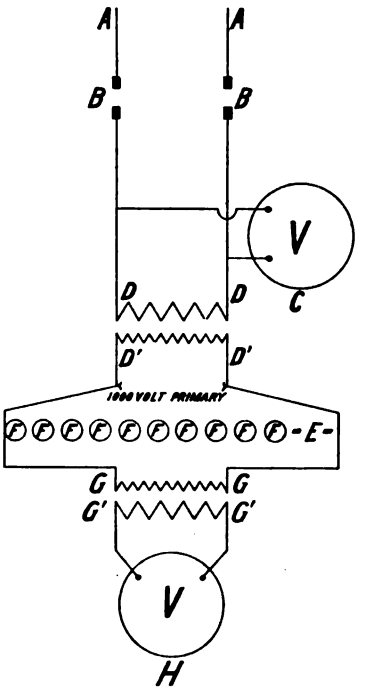


FIG. 1.

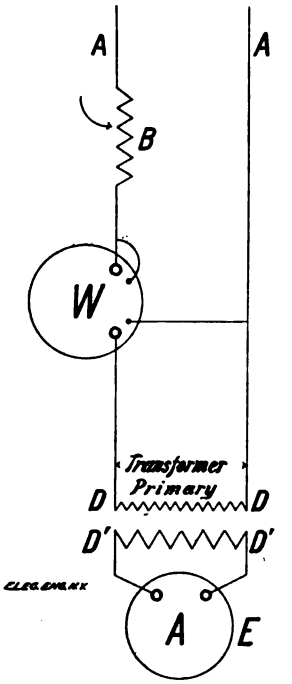


FIG. 2.

on the wattmeter W. When the current as shown on E has attained its proper degree, divide the reading in watts by the watt capacity of the transformer, and the result will be the per cent.

For example: If the transformer under test is of 2,000 watts capacity wound for 1,000 to 50 volts and we wish to find the C^2R losses, we will connect primary DD through wattmeter W, and resistance B to supply line AA of 100 volts, and secondary D'D' to an ampere meter E, varying resistance until E shows 40 amperes. We now observe that the indication on wattmeter W is 40 watts. This is the C^2R loss, which if divided by the capacity of the transformer, 2,000, will give 2 per cent. C^2R loss.

Core Loss Test.—To test iron or core loss, connect as shown in Fig. 3. AA supply line. B voltmeter. C wattmeter of approved pattern. DD secondary of transformer and D'D' primary. The voltage on meter B must be equal to that which the secondary of the transformer is designed to deliver. Leave primary D'D' open and free from case or ground. The reading on meter C will be the iron or core loss in watts, which to express in percental form, we divide the loss in watts by the watt capacity of the transformer, i. e., the watt capacity of the transformer is 1,000 and the core loss in watts as shown by meter C is 20 watts, the core loss per cent. will be 20-1,000 or 2 per cent.

Insulation Test.—Make the connection shown in Fig. 4. AA 100 volt supply line. BB primary or low potential coil of testing set converter. B'B' secondary or 10,000-volt side of testing

Digitized by Google

set converter. CC secondary of transformer under test. C'C' primary of transformer under test. DD core of transformer. E case of transformer. F connection of core to case. G connection of secondary to case. HH fuse block 10 inches long, through which 10,000-volt terminal B' is connected. I one end of the 10,000-volt coil connected to secondary of transformer. J one end of 10-000-volt coil and one end of primary of transformer.

After making the connections just indicated, connect the wires at J for about quarter or half a minute. If the one ampere fuse

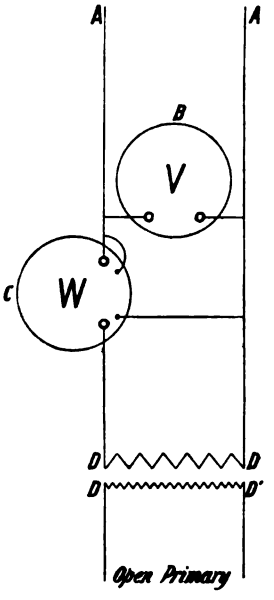


FIG. 3.

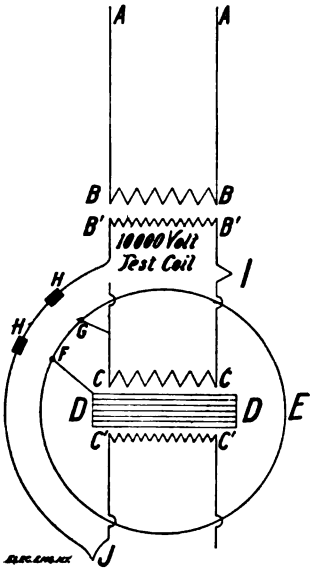


FIG. 4.

in block HH does not blow, the transformer is free from flaws between primary and secondary.

Important.—It is of prime necessity to connect the leg of the secondary with the iron core and also with the case.

In handling the 10,000-volt current extreme care should be exercised, as negligence might easily divert it into a powerful agency of destruction both to life and property.

Motor Carriage Contests in Boston.

A NOVEL and decidedly interesting motor carriage contest was held on Wednesday afternoon, Nov. 9, at the Charles River Park, Cambridge. The contest was under the auspices of the Massachusetts Charitable Mechanic Association, the management offering $1,100 in prizes.

Over 1,500 people witnessed the contest, and the attraction proved to be of much interest.

Probably the chief event, and the first, was the speed contest, a two-mile pursuit race. The entries were as follows:

De Dion gasolene tricycle, operated by K. A. Skinner; Haynes, Apperson & Co., gasolene carriage, operated by O. H. Perry; Whitney steam carriage, operated by George E. Whitney, and Whiting gasolene carriage.

The contest was won by the De Dion vehicle in 5m. 1 2-5 s. The Whitney steam carriage was second.

In the brake efficiency contest, the Riker electric carriage was first, stopping at 6 feet 1 inch, and the Haynes gasolene carriage second.

The next was the manageability contest, and in this the star was the De Dion tricycle. Each vehicle was called upon to pass between six sets of posts, turning around and coming back to the line. The carriage passing between all, without displacing any, in the quickest time, was the winner, two prizes being offered. The feat required many sharp turns.

The De Dion "trike," 3 feet 4¼ inches wide, made three trials without knocking down a single post, the best time being 43 3-5s. The test won great applause. The Riker electric carriage, 4 feet 8 inches wide, and the Whitney steam carriage also did good work in this contest.

It should, however, be stated, in defence of the work done by the electric vehicle, that the distance between posts was just sufficient to allow the carriage with a 63-inch wheel base to maneuver between them. It must be remembered that a tricycle which can turn in its own length has a great advantage over a vehicle which can only turn on a 15-foot radius. The event has been contested by Mr. A. L. Riker, and the result of his appeal has not yet been made public.

The hill-climbing contest, of course, was won by the light vehicles. The Riker Electric Motor Co. had entered a standard carriage which was built for city service with no hill-climbing attachment on it, a carriage weighing without passengers 2,000 pounds; with two passengers 2,300 pounds. The Stanley carriage with one passenger weighed 750 pounds, and the Whitney carriage with two passengers weighed complete 1,000 pounds. The score for the Riker vehicle will probably stand as follows: First prize in brake efficiency, second in manageability, which has been contested, and second in hill climbing. The Stanley steam carriage ran an exhibition mile in 2m. 11s.

The judges were Isaac H. Davis, Prof. Lanza, Col. E. H. Hewings, W. O. Webber and Mr. Marks. Lon Peck was the starter and the Chronograph Club acted as timers. The prizes will be awarded and announced later.

Magnetic Iron Ore.

It is interesting to know that certain specimens of magnetite surpass most kinds of steel in their capacity of retaining magnetism. A. Abt has tested specimens of magnetite from Moravicza, in Siebenbürgen. They have a greater degree of remanent magnetism than steel manufactured by the puddling, Bessemer, or Martin processes. But they are surpassed in this respect by certain crucible steels and by tungsten steel, a Westphalian specimen of the latter showing a remanent magnetic moment of 62 units, as against 37 for "diamond steel," 34 for Reschicza crucible steel, 29 for Martin steel, 15 for puddling steel, and only 3 for Bessemer steel. In 122 days a rod of magnetite only lost 1.5 per cent. of its remanent magnetism.—Abt, Wied. Ann., No. 9, 1898.

The Buffalo General Electric Co. Starting Up Its New Machinery.

ON the afternoon of Nov. 19, the Buffalo General Electric Company, Buffalo, N. Y., made a trial of the first six 200 horse-power three-phase 352-volt synchronous motors, each of which is direct connected to two No. 11 Brush arc generators, each unit having a capacity of 250 450-watt arc lamps. They also started up the two motor-generator sets, each consisting of a 30-horse-power induction motor, direct connected to a 20-kilowatt 125-volt direct connected generator. These two complete sets form the exciters for the synchronous motors. The next day two large motor generator sets were started up, each consisting of a 425-kilowatt three-phase synchronous motor direct connected to a 400-kilowatt two-phase 62.5-cycle generator. All these machines have since these tests been put in regular service. It is very encouraging to learn that everything started off like clockwork, no hitch occurring anywhere. The company are putting in about $25,000 worth of underground cable, made by the General Electric Company, to connect to the new station and are going to put in besides a complete Edison direct connected system underground, costing almost as much more.

PERSONAL

A Dinner to Lieut. W. D. Weaver.

RECOGNIZING the fact that Mr. W. D. Weaver, editor of the "American Electrician," had been the only one of their number taking an active part in the late war with Spain, the electrical journalists of this city celebrated his safe return, after an absence of several months afloat, by a very happy little testimonial dinner at the Engineers' Club on Wednesday evening, Nov. 16. Fifteen sat down to table, all of whom but two had been or are now connected with the electrical press, and not one of whom but is a personal friend of the guest of the evening. Those present were: Mr. W. D. Weaver, Dr. Louis Duncan (an old classmate), Mr. E. G. Bernard (a former engineering associate), Mr. R. W. Pope, secretary Am. Inst. Elec. Engrs.; Mr. G. H. Guy, secretary N. Y. Elec. Society; Mr. C. T. Child, "Engineering Magazine;" Mr. John McGhie, Pubn.

Digitized by Google

Dept. General Elec. Co.; Mr. C. O. Mailloux, Mr. G. T. Hanchett, Mr. S. L. Coles, "The Electrical Review;" Mr. H. W. Blake, the "Street Railway Journal;" Mr. T. R. Taltavall, "The Electrical World;" Mr. A. E. Clifford, "The American Electrician;" Messrs. T. C. Martin and Max Loewenthal, The Electrical Engineer. An excellent dinner was served by the club steward, and the later proceedings were full of interest. Mr. Weaver gave a number of reminiscences and incidents connected with the war, many of which had come within his own observation or experience, and touched also upon the greater part that electricity is to play in all later naval operations. Reference was made to the U. S. Volunteer Engineer Regiment so largely recruited from among electrical men, and a silent toast was drunk to the memory of Mr. C. G. Davenport, of that body, and a member of the Institute, who died at the front. Speeches were made by Messrs. Pope, Duncan, Mailloux, Bernard and Coles, and a most delightful and patriotic evening was spent.

MR. LUTHER STIERINGER is receiving many well deserved congratulations on the success of the beautiful design suggested by him for the local Edison Electric Illuminating Co.'s exhibit at the Mechanic Fair in Boston. This "pergola," or roofed garden is one of the best features of the show and pleases everybody.

MR. G. H. WINSLOW, consulting electrical engineer, Schmidt Building, Pittsburg, Pa., is preparing plans and specifications for an electric lighting plant for a manufacturing company in that vicinity.

MR. W. H. LOCKE, manager of the Memphis (Tenn.) office of the Postal Telegraph-Cable Company, has been appointed manager of the New Orleans office, and will be succeeded by Mr. F. S. Kinnaird, now postal manager at Nashville.

MR. FRANCIS E. DRAKE, formerly of the Walker Company, and now in charge of American electrical exhibits for the Paris Exposition of 1900, has returned to this country with the Commissioner General to push the work in this country.

SOCIETY & CLUB NOTES

Chicago Electrical Association.

A very interesting paper entitled "Practical Points on Electrical Measurements" was read before the above association on Oct. 21, by Mr. W. B. Hale. The author, while describing no original tests, gave an elementary and able account of the most useful and practical tests used by the layman in his exterior work as well as by the student and experimenter in the laboratory. He pointed out that voltmeters and ammeters are essentially alike in construction and operation, citing as a proof of this a very interesting experiment. The tests described by the author were the following: Measurement of ordinary, low, high and insulation resistances and the internal resistance of cells. The author concludes his paper by treating his hearers to a number of "don't" paragraphs, which tell them how not to use the volt and ammeters; he also appends a chapter on practical units.

American Institute of Electrical Engineers.

The 129th meeting of the Institute will be held at 12 West Thirty-first street, New York City, on Wednesday, Nov. 23, 1898, at 8 o'clock p. m. A paper will be presented by Frederick W. Carter, of London, England, on "The Design of Transformers." Advance copies will be distributed at the meeting, or mailed upon application to the secretary. The paper will also appear in the November issue of the Transactions.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its meeting at the headquarters, 12 West Thirty-first street, from Nov. 29 to Dec. 2, when a most attractive and valuable programme of papers will be presented, accompanied by several social events. The Edison station at Duane street is to be visited and the new Stephenson car works at Elizabethport, N. J., which are driven by electrical tools. On Thursday, Dec. 1, the use of individual motors on tools is to be discussed.

OBITUARY

John W. Keely.

IN the death of John W. Keely, of Keely motor fame, which occurred at the inventor's home in Philadelphia, on Nov. 18, the world has been robbed of one of its most unique and fascinating characters and the magazines and newspapers of one of their most prolific contributors. Mr. Keely, as stated above, held a unique place in the scientific world and more so in the minds of the general public, for he captivated and held their attention for over a quarter of a century, managed to gather capital from great financiers for schemes which seemed like miracles and puzzled the scientists by his profound silence.

Mr. Keely was born in Philadelphia in 1837. His father's parents were German and French, his mother's were English and Swedish. His granfather, Mr. Ernst, was a composer and a leader of an orchestra in Baden-Baden. His father was an iron worker. Keely, early in his life, was a circus performer and a sleight-of-hand performer.

Some twenty-five years ago Keely announced that he had an engine which went of its own accord. He called it then a "hydro-pneumatic-pulsating-vacuo engine." He had a different name for it every year, and he made some 3,000 different engines of the same kind. Engineers, scientific men and capitalists made frequent pilgrimages to Keely's Philadelphia laboratory to see the "Keely motor mote." Sometimes it "moted" and sometimes it didn't, but Keely always had a great tale to tell. Keely's chief accomplishment was a ready use of a jargon of scientific and unscientific terms. He talked about the "triune currents of a polar flow of force," the "reflex action of gravity," "chords of mass," "sympathetic outreaches of distance," "depolar etheric waves," and a lot of other things which didn't mean anything, but never told why his motor "moted," and never took a patent. He was always going to startle the world, but never did. The world got tired waiting.

Some prominent New Yorkers took Keely seriously enough to raise $100,000 and form a company to put his motor on the market. Keely spent $10,000 of this paying his debts and $60,000 building a worthless "motor." In 1888 he was committed to jail for contempt of court for refusing to explain to a committee of experts the working of his machine. Mrs. Bloomfield Moore, who had literary and scientific tastes, had a faith in Keely bordering on fanaticism and spent something like $100,000 on him.

Opinions regarding the value and permanency of Keely's work differ widely, and it is to be hoped that the machine which is now being built and nearing completion, will throw some light on the mysterious force, that "negative gravity," as Frank R. Stockton called it, which this patient worker has endeavored to utilize for the service of mankind.

Latimer Clark.

IN our columns last week we made the sad announcement of the death of Mr. Latimer Clark, C. E., F. R. S., which took place at his residence at Twickenham, England, on Oct. 30. This announcement has been received with profound regrets by a large number of friends of Mr. Clark on this side of the Atlantic, and we give below a short sketch of his active and useful career.

Latimer Clark was born at Great Marlow on March 10, 1822, and attained, therefore, the ripe age of 76 years. Though it is perhaps not well known, Mr. Clark was at first connected with the chemical manufacturing industry, and commenced railway surveying in 1847. He was appointed assistant engineer for the construction of the Britannia tubular bridge across the Menai Strait, under his brother, Mr. Edwin Clark, the resident engineer. During his stay at Menai Bridge Mr. Latimer Clark used electricity to fire a time-gun every evening at 8 o'clock. The attention of the chairman of the Electric Telegraph Company was, through this, called to the young engineer, who, in 1850, was appointed assistant engineer to the company, under his brother, becoming afterwards their engineer-in-chief and consulting engineer.

Many improvements in the telegraph system were subse-

Digitized by Google

quently introduced by Mr. Clark; and a very able report on the subject of underground telegraph wires was prepared by him in 1860, which was embodied later in the Government report in 1861. He was the first witness to the retardation of electric signals by induction in submarines lines, and to demonstrate that currents of low tension travel as fast as those of high tension. In 1859, Mr. Clark invented and patented the double cup insulator for overland telegraph wires, now so largely employed throughout the world. To him is due the important invention, in 1854, of the pneumatic transmission of messages, now so largely used. The invention of a method of protecting submarine cables by Clark's compound followed in 1858. In 1860 he acted as a member of the committee appointed jointly by the Government and the Atlantic Cable Telegraph Company to inquire into the whole subject of submarine telegraph cables. Mr. Clark was also for many years engineer to the Indian Government cable lines in the Persian Gulf. His determination of the effect of temperature on the insulation of gutta percha cables, in connection with Sir Charles Bright, in 1863, proved highly valuable, and is still in daily use. He also, with the same gentleman, originated in 1861 the system of electrical measurement in ohms, volts and farads, which has now come into universal use, and has conferred such vast benefits on electrical science. The paper on this subject was read at the British Association at Manchester in September, 1861, before the formation of the well-known British Association Committee on Electrical Units, and led to the appointment of that committee. He is also the inventor of the well-known Clark's standard cell.

As head of the firm of Clark, Fords & Co., Mr. Latimer Clark has been connected with the submergence of some 100,000 miles of submarine cables in all parts of the globe. We may mention the publication by him, in 1868, of a Treatise on Electrical Measurement, and in 1871, in conjunction with Mr. Robert Sabine, of his electrical tables and formulæ for operations in submarine cables, besides other papers of great value. Mr. Latimer Clark has taken out a large number of patents in different countries, many of his inventions being of great value. For a number of years a partner in the engineering firm of Clark & Standfield, and the late firm of Latimer Clark, Muirhead & Co., he has brought out many important improvements in different branches of engineering, and was still head of the firm of Clark & Standfield, the well-known dock engineers. Mr. Clark was the author of several astronomical works, and of a valuable dictionary of metric and other useful measures. Besides being a Fellow of the Royal Society, he was a Chevalier of the Legion d'Honneur and past president of the Society of Telegraph Engineers.

THE STOCK MARKET

Favorable Conditions.

The conditions of trade throughout the county, of export trade, and of the stock market, remain very satisfactory, and there seems no good reason to question their permanence. Some idea of the general activity may be formed from the fact that the bank clearings last week were the heaviest on record by Bradstreets and $200,000,000 in excess of the heaviest previous week of which there is any record.

During the past week, 7,215 shares of Western Union were sold, closing at 93½; of General Electric, 7,375 shares, closing at 82, and of New York Metropolitan Street Railway, 38,414 shares, closing at 174⅝. All stocks were strong, and the sales of bonds were phenomenal. In Boston, American Bell Telephone sold up to 282, and West End Railroad at 88.

The metal markets remain strong and firm, copper, New York, being quoted at 12.87½.

MANHATTAN ELEVATED report for the last quarter shows a loss of 3,000,000 fares and although the general showing is bad, charges nothing off for depreciation. There are many people who think an effort is being made to let the property run down, shake out the weaker stockholders, and then "boom her up again" with electricity. In 1893 the passengers carried were 219,000,000. For the last year they are less than 179,000,000, or a loss of 40,000,000 passengers a year.

TRADE NOTES AND NOVELTIES

The Storage Battery Supply Co., N. Y.

On September 12, 1898, the Storage Battery Supply Company was incorporated under the laws of the State of New York. For the past seven years this business has been carried on by Theodore D. Bunce. All lines of storage battery work have been undertaken, including manufacture, rental, recharging and repairing. With increased capital and better facilities, the company intend to manufacture a larger line of goods, to carry a larger stock of cells for rental service, and in every way to improve the business to meet the growing demand. They will issue at an early date illustrated circulars descriptive of their work in all its branches, which will include standard cells in glass and rubber jars, cased batteries of every description, medical and dental outfits, carriage and yacht lighting plants, and full details relating to the rental and recharging of batteries.

Imperial Rheostats.

THE accompanying cuts, Figs. 1 and 2, represent two different forms of motor speed regulators, manufactured by the Ohio Electric Specialty Mfg. Co., of Troy, O. Fig. 1 is the floor type of motor speed regulator, regulating a 7½ h. p. motor,

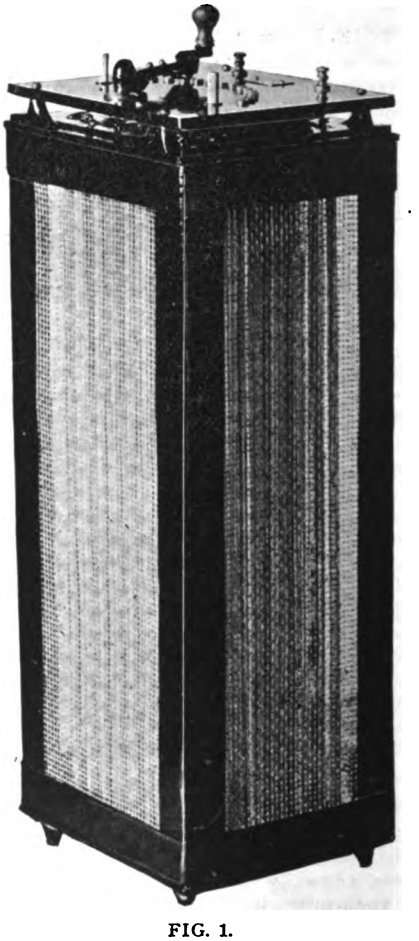


FIG. 1.

giving 15 gradations of speed and standing a continuous flow of current with motor at full load. Ample ventilation is given throughout the entire rheostat, and as a whole it is constructed in a very substantial manner.

Fig. 2 represents the wall type of speed regulator, giving six different speeds. It has been in successful operation for a number of months controlling ventilating fans, etc. This rheostat is built in a very compact form, with resistance coils readily acces-

Digitized by Google

sible. Special resistance wire is used in all these boxes and the coils are wound in a way which prevents short-circuiting. Being constructed as far as possible of slate and metal, the boxes are rendered fireproof. The arm for inserting resistance is hinged in such a manner as to obviate any looseness, and no adjustment is required; it insures a closer contact the heavier the load it is required to carry. All contacts have ample capacity and as to finish they are said to be second to none on the market. These boxes are finished with automatic release if required, the device for inserting resistance being the same that is

FIG. 2.

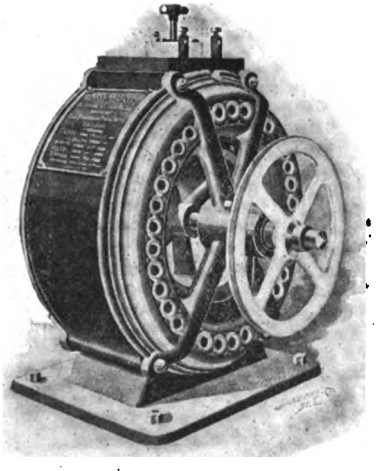
used on their well known motor starter having automatic release.

Handsomely marbelized slate is used on the face of all these rheostats, together with other symmetrical parts, making them an ornament wherever they are placed.

This company is making a special effort in this department to increase this part of their business, which they have made a specialty of for some time past. Additions are being made constantly to enable them to make prompt shipments.

Emerson Special Slow Speed Laboratory Motor.

THE special slow speed laboratory motor, shown below, has been placed on the market by the Emerson Electric Manufacturing Company, St. Louis, Mo., in response to a general demand for an alternating current motor giving more power than



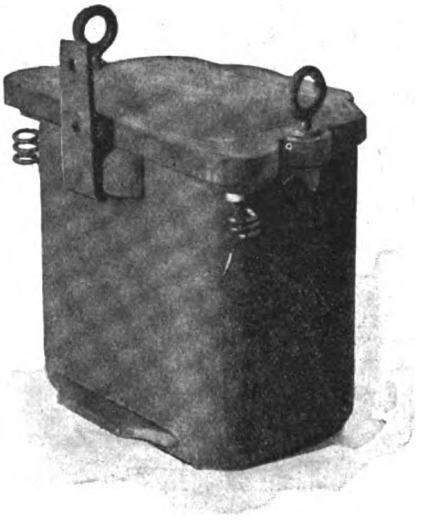
EMERSON SPECIAL SLOW SPEED LABORATORY MOTOR.

can be obtained from the ordinary small sizes of induction motor types, and less than the regular alternating current power motors of half horse-power and upward. They are intended for use on plate glass machines, dental work, small pumps and similar uses. Its extremely low speed gives it quite a strong torque at the pulley and makes it much more convenient to arrange for direct belting or gearing without the intervention of countershafts.

The machine develops three or four times the power of the ordinary 16-inch fan motor and is considerably lower in price than the ½ h. p. alternating current power motors. Prices and further details will be cheerfully furnished on application.

A New Line of Lakon Transformers.

THE Lakon Company, of Elkhart, Ind., has recently published a booklet entitled "The Lakon—A Book for the Busy Man on Alternating Currents and Transformers." A

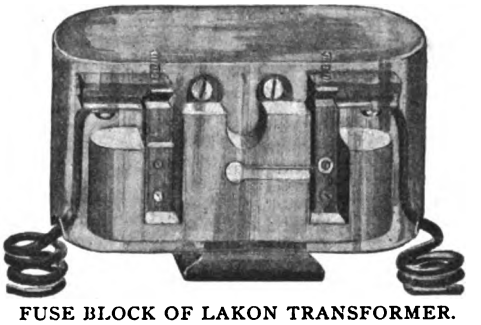


LAKON TRANSFORMER, REAR OF CASE, SHOWING HANGING DEVICE.

unique feature of this booklet is a description of the principles of alternating currents, with special reference to their application to transformers. The book describes the new line of transformers which this company have recently placed upon the market. These transformers are of the oil type, and, although they may be used without oil, the company strongly advise the use of oil in all sizes, as the oil aids in the dissipation of heat and prevents deterioration of insulation due to high temperatures. A pair of very strong and simple all-porcelain fuse boxes are furnished with each transformer.

The method of hanging is extremely simple. It is with extreme ease and facility that the light Lakon hanging hook can be held in position and lag screws and bolts put in place by one man, and when the transformer is hoisted to be hung upon the hook it can be swung into position and quickly and easily lowered into the hanging hook.

A transformer having a high full load efficiency will not nec-



FUSE BLOCK OF LAKON TRANSFORMER.

essarily have a high all-day efficiency, and it is the all-day efficiency which is important. In order to secure a high all-day efficiency the transformers have been designed for a very low core loss and good regulation is secured by a symmetrical arrangement of the windings and a liberal use of copper. The primary and secondary cables are brought out on opposite sides of the case through heavy porcelain bushings, and are firmly cemented into the porcelains, so that there will be no chafing or wearing

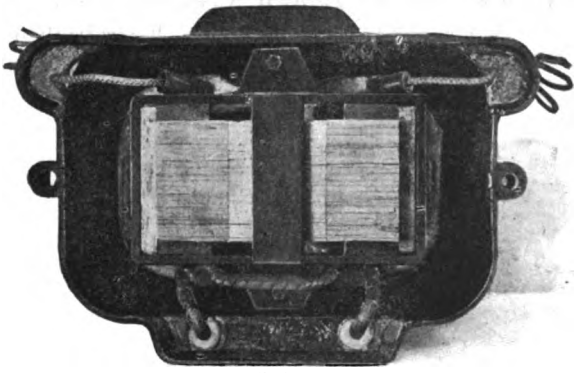
Digitized by Google

away of the insulation where the cables come through the case.

The ageing of iron has been investigated by this company and they will replace within two years any transformers that will show any marked change in efficiency due to ageing of iron.

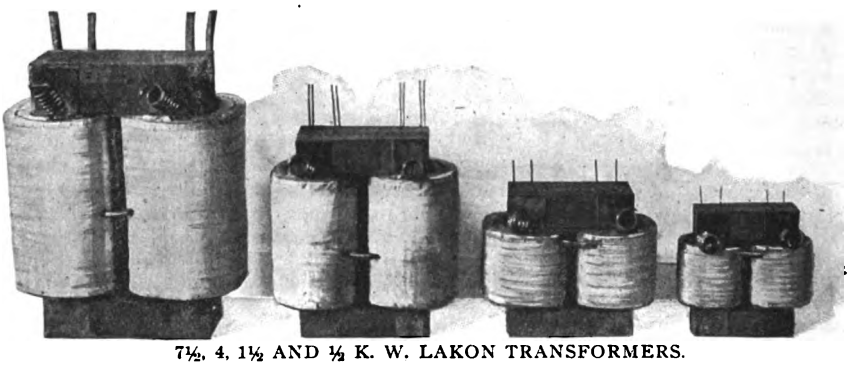
In the Lakon transformer the coils are so arranged that a very large surface of copper is exposed to the oil so that the temperature is kept down to a very low figure.

The transformers are designed to withstand a very high breakdown test between primary and secondary and between primary and core. While a very high insulation between primary and



INTERIOR VIEW OF LAKON TRANSFORMER.

secondary is a safeguard against burn-outs from lightning, a transformer cannot be made in which the insulation in itself is enough to withstand the extremely high potential of a lightning discharge and the company advocates a more general use of lightning arresters. Metallic ground shields will be placed in transformers when specified, but they do not advise the use of them on account of the increased danger of a puncture in the insulation due to a lightning discharge. The ground shield being connected to earth affords a free path for lightning, and



7½, 4, 1½ AND ½ K. W. LAKON TRANSFORMERS.

they believe that the transformer is more liable to be burned out by lightning when ground shields are attached. The ground shield will prevent the lightning discharge from appearing on the secondary circuit, but it is not a protection to the transformer.

This company manufacture transformers for alternating current arc lamps, step-up and step-down transformers, and transformers for special purposes, such as electro-cautery, electric winding or testing purposes.

Fire Engineers in St. Louis.

During the recent meeting of the International Association of Fire Engineers in St. Louis, they were shown the auxiliary fire system. The report says: "On the suggestion of Chief Bosch, Superintendent of Fire Alarm Telegraph System, of Newark, N. J., the auxiliary fire alarm system was shown to the members. After the exhibitor had demonstrated to the convention the benefits and advantages of the use of this auxiliary fire alarm service, he explained that this auxiliary fire alarm was first introduced by the Gamewell Company. Then the Auxiliary Company concluded that it would be better for all concerned if they took an interest in its management, and since that time have endeavored to perfect it and make it, as far as it is used, absolutely reliable. Recently they had combined with the original auxiliary telegraph, and used what is known as the Montauk Multiphase automatic fire detective cable. The exhibit is placed before you to illustrate the combination of the Auxiliary and the Montauk Multiphase alarm cable, which is absolutely and solely a thermostat—the automatic transmitter telegraph for the interior of buildings, doing away with or aiding night watchmen who have long rounds to make, or it may be connected from the outside with the fire alarm system. The flame from an ordinary match will set it off anywhere."

Safety Appliance Company's Roof Drainer.

Anyone who has had the misfortune of riding in an open car during a rainstorm has had good cause to feel ill-natured upon finding the seat which he wants to occupy covered with water. The Metropolitan Street Railway Company, of New York, were quick to perceive this feature, which they at once remedied by fitting their cars with the well known roof drainer manufactured by the Safety Appliance Company, Limited, Wentworth Building, Boston, Mass. It consists of a drip rail placed on the under side of the name plate and connected with hollow grab handles. These take all the water and convey it under the running board, where is is deposited on the track. These drainers find considerable favor with street railway men, and are fully described in a handsome pamphlet issued by the above named company.

Westinghouse Gas Engines.

At the electrical exhibition in New York last May there was exhibited a Westinghouse three-cylinder gas engine direct connected to a dynamo which attracted a great deal of attention. These engines, which have been on the market for a little over two years, have already become very popular with central station men and engineers of isolated plants. It was first publicly exhibited at the Pittsburg Exposition in the autumn of 1896. The total number actually built is 216, with an aggregate horse power of 10,179. One hundred and fifteen of these engines are in the course of construction at the present time. It may be interesting to state that the average consumption of Pittsburg natural gas per brake horse power per hour, on engines of from 20 to 30 h. p., is 12 cubic feet. It is somewhat more on smaller sizes and less on the larger ones. The two-cylinder engines are built from 10 to 70 h. p. and the three-cylinder ones from 28 to 750 h. p., the latter being the largest gas engine ever built by any manufacturer. These gas engines regulate by adjusting the charge admitted in proportion to the load. The number of explosions is constant. This explains the smooth, steady and comparatively noiseless action.

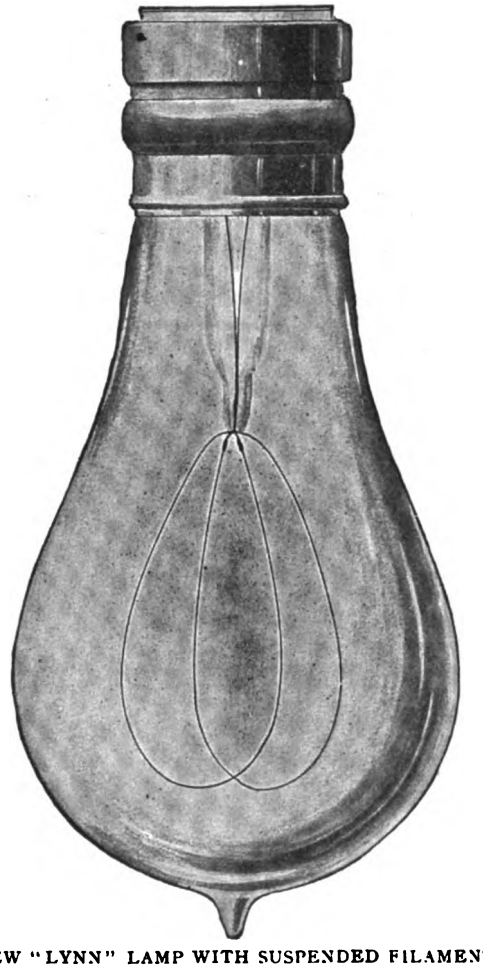
The two-cylinder engine receives an impulse at every revolution and the three-cylinder ones an impulse every two-thirds of a revolution. The power ratings are conservative, and are given in actual or brake horse power—not indicated. Every engine has a surplus capacity of 10 to 15 per cent. above the rating. The engines are manufactured by the Westinghouse Machine Company, Pittsburg, Pa.

BRIDGETON, ME. The new bridge just erected for the town of Bridgeton has a clear span of 36 feet, a roadway of 22 feet wide and a sidewalk 6 feet wide. It is of steel throughout except the floor plank, having latticed girder trusses and steel beams for the floor. The Berlin Iron Bridge Company, of East Berlin, Conn., were the contractors for furnishing and erecting the bridge.

Digitized by Google

New Lamp of the Lynn Incandescent Lamp Co.

THE Lynn Incandescent Lamp Company, of Lynn, Mass., have placed on the market a new lamp which is specially adapted to street car lighting, boats, hotels and office buildings for the reason that it can be placed in any position, even horizontal, without the filament drooping. The filament is shorter and larger in diameter than those of other makes, and being of a definite diameter, insures a uniform current consumption. This



NEW "LYNN" LAMP WITH SUSPENDED FILAMENT.

is an important feature in lamps placed in series. Another feature is that it is not injured by vibrations of car or boat. This company, we understand, are the only renewing company also making new lamps, and consequently the only one that can exchange either new or renewed lamps for burned out ones. They can be addressed for price lists and circulars and their method of maintaining a supply of lamps "at rock bottom prices."

SOUTHERN NOTES

BLACKSBURG, VA. The Montgomery Intelligence Company have just completed ten exchanges in the county, of 50 drop capacity each, besides some thirty odd miles of toll line. More work is in contemplation. All the apparatus used is that manufactured by the American Electric Telephone Company, and their "Express" board is used in each exchange. The president of the company is Hon. A. A. Phlegar; treasurer and manager, Mr. Aaron Graham; electrician, Mr. L. H. Lancaster, of Blacksburg.

HARPER'S FERRY, W. VA. The city council have awarded to the Harper's Ferry Electric Light and Power Company the franchise and contract for lighting the town with arc and incandescent lights. Mr. John L. Livers has the contract for erecting this equipment and expects to have the plant in operation before January 1, 1899.

NEW YORK NOTES

MR. E. L. POWERS, 150 Nassau street, New York City, and Monadnock Block, Chicago, is issuing two excellent directories in cheap but handy and complete form, brought right up to date every few months. One is devoted to electric lighting companies and one to electric street railways. The information is very copious and detailed. We commend these quarterly publications heartily to our readers.

MR. W. W. BOSTWICK, JR., formerly representing the Western Telephone Construction Company, of Chicago, in this city, has now become connected with the Schmidt & Bruckner Electric Company, and is already doing a large business for them in their telephonic and other specialties.

THE EDDY ELECTRIC MFG. CO., of Windsor, Conn., have opened a direct office at the Central Building, 143 Liberty street, of which Mr. H. B. Coho is the manager. He represents all the lines of their large and popular product in motors, dynamos, platers, etc.

EDISON JUNIOR ELECTRIC LIGHT AND POWER CO. has been formed under the laws of West Virginia, with headquarters in New York City, capital subscribed, $100, with privilege of increasing to $500,000. Its purpose is to make, sell and deal in electrical apparatus, batteries, etc. Stock is held by T. A. Edison, Jr., V. Robinson, H. C. Hepburn, E. A. Drake, C. S. Henry, R. M. Jordan, J. G. Batterson, Jr., and F. J. Stone, all of New York City.

EDISON-BROWN PLASTIC BONDS have been bought by the government for the Naval Proving Ground, Indian Head, Md., for the electrical connection of steel rails. The first order is for eight hundred pairs. The engineers advising the government had been watching some bonds for about two and one-half years. A further order has since been given, making a remarkable testimonial.

AMERICAN ENGINE CO., Bound Brook, N. J., have just shipped a 25 k. w. direct connected plant for the Porvenir sugar estate in the Republic of San Domingo, the first of the kind there. The company are also installing a 35 k. w. plant complete of their own manufacture in the Grenoble Apartment House, West Fifty-seventh street.

SCHMIDT & BRUCKNER ELECTRIC CO., 209 Greenwich street, New York, is branching out into many specialties both in regard to interior and exchange telephone apparatus, and invites all parties who are in the market for telephone apparatus of any description, to drop in and see them and look over their goods and their manufacturing facilities for turning out fine work. They make a specialty of selling transmitters separate, and the demand is continually on the increase for this line of goods. They advise us that they will be pleased to send samples of their new arm or other parts to any parties desiring to investigate their apparatus. They have also a very handsome "Poster" that will be mailed for the asking.

WESTERN NOTES

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, Mo., who are agents for the Adams-Bagnall arc lamps, report the new enclosed alternating arc lamp a perfect success, away beyond their expectation, and is fully up to the usual high standard of the Adams-Bagnall lamps for other circuits. They are now prepared to furnish these lamps and solicit correspondence from all interested.

GREGORY ELECTRIC CO. has been formed in Chicago with a capital stock of $100,000. The incorporators are Charles E. Gregory, G. A. Fargher and George K. Wadsworth.

THE "IMPROVED PERFECTION" GUARDS of the Wm. Inglis Wire and Iron Works, 68 West Congress street, Detroit, Mich., are very popular among central station people through the country and have proved meritorious in every respect as a guard for lamps. They will be glad to answer inquiries, send samples, etc.

FOSTORIA INCANDESCENT LAMP CO. have opened an Eastern office in the White Building, 95 and 97 Liberty street, New York City, where the Crouse-Tremaine Carbon Company

Digitized by Google

will also have their headquarters. Mr. H. Stillson Hart is the Eastern representative and will be glad to be favored with inquiries, calls and orders.

WESTERN ELECTRIC CO. has in stock a large and complete assortment of weatherproof sockets and receptacles for Thomson-Houston, Edison and Westinghouse bases. Orders for material of this kind will receive prompt attention.

KOKOMO, IND. A visit to the Kokomo Telephone and Electric Manufacturing Company's new plant here will well repay the visitor. He is at once impressed with its complete equipment, its splendid offices and its neat appearance. This company, although young, is well in the van among telephone manufacturers. Success is due to the excellent quality of its product and to good business management. Mr. Lawrence Snider is president, and Mr. J. P. Hutchings, secretary. It has just issued catalogue No. 5, which is up to date, and anyone interested can have a copy for the asking.

WESTINGHOUSE ELECTRIC & MFG. CO. has recently secured a contract from the Wabash Paper Co., Wabash, Ind., for the generator and motors for a factory transmission of 300 kilowatts. The generator will be two-phase, direct connected to an Allis cross-compound condensing Corliss engine. This will be the first calendered paper mill in the West to adopt electric drive.

GEO. W. PATTERSON, 1539 Marquette Building, Chicago, reports a phenomenal success for his "Jubilee Souvenir," "History of the Spanish-American War with Handy Atlas Maps," and now extends a cordial invitation to those handling or using American Circular Loom flexible conduit, Boston Electroduct steel tube, Gordon or Law primary batteries, Welsbach or New Era electric gas lighters or Standard knife switches, to call at his office and secure a copy of this valuable souvenir.

ADVERTISERS' HINTS

THE AMERICAN PEGAMOID CO., 346 Broadway, New York, advertises the aluminum paint. This has the appearance of frosted silver and is the latest application of aluminum. It is said to dry quickly, that it is untarnishable, washable and proof against water, oil, grease and the weather. It makes an excellent protection for dynamos, motors, arc lamps, and work in general. A sample bottle will be sent by mail for 25 cents.

THE EDISON LAMP WORKS, Harrison, N. J., remind their friends that Christmas is coming and that electric decorations will be in order. They are prepared to ship thousands of miniature decorative lamps and receptacles under a few hours' notice. They advise that no delay will be made in filling orders.

AMERICAN REFLECTOR AND LIGHTING CO., Chicago, Ill., illustrate their advertisement with the cut of one of their popular reflectors. They are all of pleasing appearance and neat, for which they are designed.

THE VICTOR TELEPHONE MFG. CO., 166 South Clinton street, Chicago, Ill., say that science and art go hand in hand in the make-up of Victor apparatus, and as an instance they call attention to their style "K" telephone as adapted to long distance and toll line work.

E. A. HUEBSCH & CO., 31 Rose street, New York, say that their year books are much better than calendars as a means of advertising. Will be glad to furnish particulars on inquiry.

B. F. STURTEVANT COMPANY, Boston, Mass., advertise the Sturtevant generating sets with horizontal engines in sizes up to 75 k. w. They are made in seven distinct types and 36 sizes. Their "G" describes them.

HUEBEL & MANGER, 286 Grand avenue, Brooklyn, N. Y., advertise cast bronze push buttons of all styles and finishes.

WESTERN ELECTRIC CO., Chicago and New York, call attention to their metal shades of standard quality as being practical, useful, durable and therefore economical.

WESTINGHOUSE ELECTRIC AND MFG. CO., Pittsburg, Pa., remind the public of the developed and perfected "Tesla" induction motor. This is the only motor supplying Niagara power in Buffalo. They challenge comparison of its simplicity for construction and operation.

WESTINGHOUSE MACHINE CO., Pittsburg, Pa., say that everybody knows that they build big engines, but everybody does not know that they build small ones. They say further that each and every order receives their most careful attention.

NEW ENGLAND NOTES

MR. JESSE W. STARR, Room 2, Unity Building, Hartford, Conn., has just bought the charter of the Willimantic, Conn., Street Railway Company, and will require boilers, engines and all other apparatus necessary to equip ten miles of road. He will be glad to receive inquiries and propositions.

NORTHBORO, MASS. The General Electric Company is putting a six-pole generator in the power house of the Worcester and Marlboro Street Railway Company, and the Green Engine Company, of Providence, will furnish a 500 h. p. engine. A local paper states that the "amateur" has arrived, but this is not understood as applying to the engineer in charge of construction.

THE POPE MFG. CO., of Hartford, Conn., has issued the Columbia Desk-pad Calendar for 1899. This handy reminder has been for years one of the most pleasing of special advertising features. We note that the new calendar is very similar in design and make-up to the 1898 calendar, although it has more artistic covers and is more profusely illustrated. Any person may obtain a copy by applying to the nearest Columbia dealer or by sending five 2-cent stamps to the Calendar Department, Pope Mfg. Co., Hartford, Conn.

CONTENTS.

EDITORIALS:
Mr. Tesla to His Friends 514
His Friends to Mr. Tesla 514
Greatest Discovery of the age 515
The Evolution of the Surface Contact Railway 515

ELECTRIC LIGHTING:
The New Station of the Boston Electric Light Co. (illustr.) 505
New Work in the Chicago Edison Station at Harrison Street (illustr.) 508
The Wright Discount Meter and Its Use in Central Station Management (illustr.) 509

POWER TRANSMISSION:
Discussion of the Conkey Printing Plant Transmission 510
Operation by Electricity of the Prospect Park Incline, Niagara (illustr.) 511
The Growth of Electric Power Transmission (illustr.) 511

TELEPHONY AND TELEGRAPHY:
The Novel Switchboard at the Harlem Exchange of the New York Telephone Co. 512

ROENTGEN RAYS:
Corpuscular Theory of Röntgen Rays.—Mutual Influence of Cathode Surfaces 513

ELECTRIC TRANSPORTATION:
Surface Contact Electric Railways (illustr.) ..... Edward H. Johnson. 516
Financial Condition of Connecticut Trolley Roads.—The Trolley Special of the Richmond Commuters 518

MISCELLANEOUS:
High Voltage Power Transmission—I. ..... Charles F. Scott. 519
The Patent and Trade-Mark Revision Committee 520
Instructions for Testing Transmormers (illustr.) 521
Motor Carriage Contests in Boston.—Magnetic Iron Ore.—The Buffalo General Electric Co. Starting Up Its New Machinery 522

PERSONAL:
A Dinner to Mr. W. D. Weaver 522
Mr. Luther Stieringer.—Mr. G. H. Winslow.—Mr. W. H. Locke.—Mr. Francis E. Drake 523

SOCIETY AND CLUB NOTES:
Chicago Electrical Association.—American Institute of Electrical Engineers.—American Society Mechanical Engineers 523

OBITUARY:
John W. Keeley.—Latimer Clark 523

THE STOCK MARKET:
Favorable Conditions 524

TRADE NOTES AND NOVELTIES:
The Storage Battery Supply Co., New York.—Imperial Rheostats (illustr.) 524
Emerson Special Slow Speed Laboratory Motor (illustr.).—A New Line of Lakon Transformers (illustr.) 525
Fire Engineers in St. Louis.—Safety Appliance Co.'s Roof Drainer.—Westinghouse Gas Engines 526
New Lamp of the Lynn Incandescent Lamp Co. (illustr.).—Southern Notes.—New York Notes.—Western Notes 527
Advertisers' Hints.—New England Notes 528

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. DECEMBER 1, 1898. No. 552.

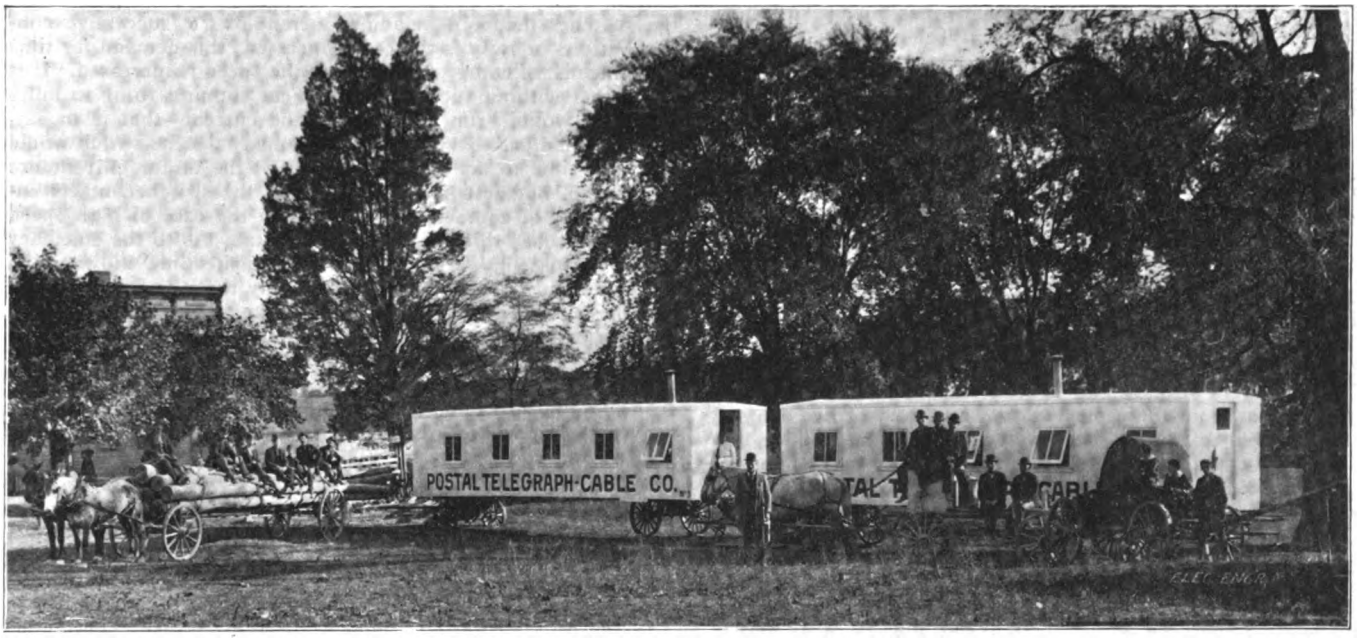
TELEPHONY AND TELEGRAPHY

The Postal Telegraph Company's Caravan.

THE idea of using highway cars for telegraph gangs, while working in desolate regions, suggested itself to Foreman McCollum, of the Postal Telegraph Co., during the season of '95, while he was using tents along the highway, crossing the mountains near Carbondale, Pa. During the following season his project received the sanction of Mr. C. M. Bills, then superintendent of construction, and during the summer of '97 the first outfit, which was somewhat crude, was built under Mr. McCollum's direction. The results were so satisfactory, however, that early in the season of '98 Mr. McCollum, who has succeeded to the position of general foreman, submitted to General Superintendent of Construction Cochran plans for the cars now in use. Mr. Cochrane, after going over the matter very carefully and suggesting some improvements in the matter of construction and equipment, authorized the general foreman to proceed with the work of building two outfits which should be first-class in every particular. These cars were built and put into service at once, having given great satisfaction and proving an inestimable convenience. A description and illustration of the caravan and its equipment is given below.

The length of the cars is 22 feet, width 8 feet 6 inches; height 6 feet 6 inches, with a 6-inch rise to centre of roof. The cars rest on five built-up sills 3 inches by 6 inches, running lengthways, made of the best quality Georgia pine. On these sills are laid two thicknesses of best Georgia pine matched flooring, making flooring 2 inches in thickness. The frame of the cars is of the best quality of white pine 2 inches by 2 inches for studding. Plates on which the rafters rest, and to which the studding is fastened, are of best white pine, 2 inches by 4 inches. The rafters are of cypress, 2 inches by 6 inches. They are placed about 2 feet apart, making a very stiff, though light, frame. The siding is of the best ⅜-inch white pine protected by several coats of white lead and oil and finished with one coat of zinc and oil. The cars are sealed inside with ⅜-inch by 2-inch cypress, over which is laid one thickness of heavy paper covered with the best quality of tin roofing.

The dining room car is divided into three compartments, namely, dining room, kitchen and cook's sleeping room. The sleeping room is 6 feet by 8 feet, equipped with two spring beds 6 feet long by 2 feet 6 inches wide, one above the other; two chairs, wash stand, bowl, pitcher, looking glass, comb, brushes and other necessary toilet articles. The floor is covered with Brussels carpet. The kitchen is 8 feet by 8 feet, equipped with a No. 9 steel range and all necessary cooking utensils. The kitchen cabinet is partitioned off, for convenience in storing cooking utensils, and so forth, the top of the cabinet being used as a kitchen table. The dining room is 18 feet 6 inches long, 8 feet wide, equipped with a table 17 feet long, arranged to accommodate 20 people. A bench is built along the side of the car to be used as seats on one side, while folding camp chairs are used on the other side. On the opposite side of the car is a cupboard 6 feet wide and 14 inches deep, extending from floor to ceiling, furnishing storage for dishes, glassware, cutlery, etc. Next to that are bins to store vegetables, flour, meal, and so forth. The car is fitted with a refrigerator 8 feet 6 inches by 2 feet 8 inches, and 5 feet long, which holds 400 pounds of ice and has sufficient room to care for milk, butter and meat necessary for 20 men. Shelves are arranged under the dining room table for storage of canned goods, with capacity sufficient to accommodate 200 cans. The cars have five windows on each side, 24 by 30 inches, and a door at each end 2 feet 6 inches wide by 6 feet high. The windows are hinged from the top so that they can be swung out to admit air, and at the same time exclude rain. The windows and doors are fitted with screens to exclude flies and other insects. The equipment of the car includes tablecloths, napkins, dish towels and other table linen necessary for the accommodation of 20 men.



THE POSTAL TELEGRAPH-CABLE COMPANY'S CARAVAN.

The sleeping car is of the same size as the dining room car, equipped with eighteen spring bed bottoms, arranged in two rows on each side of the car. The beds are 2 feet 6 inches wide and 6 feet long. They are furnished with cotton mattresses, feather pillows, cotton sheets and pillow slips. Three pairs of woolen blankets are furnished for each bed. Hooks are arranged in convenient places to hang clothes and shoes, and proper storage room is furnished for the men's grip sacks and light baggage. In the aisle between the beds is a strip of Brussels carpet extending the entire length of the car. At one end of the car is a stove capable of heating the entire car in ordinary weather. The car is so arranged that room can be made for an additional stove at the other end in severe weather. In the front end of the car has been built a writing desk and cabinet of suffi-

Digitized by Google

cient size to enable one man to work comfortably. This is for the accommodation of the foreman, and serves as a secure place for keeping all necessary papers, vouchers, etc. It also furnishes a place for members of the gang to write letters or do similar work at odd times. The car is liberally supplied with towels, brushes, combs and necessary toilet articles. The cars are in charge of a man and his wife, the man acting as janitor and man-of-all-work about the camp, the woman acting as cook. The cars are swept every day and scrubbed twice a week, oftener if necessary, being kept at all times scrupulously clean. The trucks on which the cars are mounted weigh 1,600 pounds each. Front wheels are 32 inches in diameter, rear wheels are 38 inches in diameter, and are fitted with 4-inch tires, and are set to track 6 feet. The front axle is fitted with a complete circle, and the body of the car is mounted high enough to allow the front wheels to turn under it, making it possible to turn the cars around in a small space. The trucks are warranted to carry 10,000 pounds each. The estimated weight of each car, including trucks and equipment, is 8,000 pounds. They are usually moved about 4 miles, two teams being attached to each car, although on fairly level roads they have been moved with one team each.

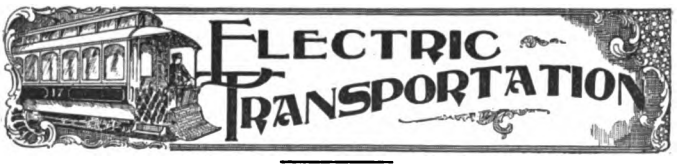
With each camp outfit is a cable truck capable of carrying 3,000 feet of 25-conductor cable. The truck is built especially for this purpose. The reel is enclosed underneath, and the truck is fitted with a semi-circular cover which closes over the cable from the top and protects it when not in use. This cable is designed to prevent interruption to business when repairing lines and transferring wires. It is placed in circuit and is used where old wires are being taken down and new ones put up, or where wires are being transferred. The Postal Telegraph-Cable Company has three of these outfits in use, one near Elmira, N. Y.; one near Baltimore, Md., and one near Somerfield, Pa. The dimensions of the cars are such that they can readily be shipped on ordinary flat cars over any rialroad, if desired.

Government Pay Telephone Stations in Paris.

A special dispatch from Paris of Nov. 15 says: The French Government has solved the much vexed telephone problem and will at once introduce in Paris, and all the larger cities of the country, a new system of telephone service.

The plan provides for the erection of a large central station and a number of substations in different parts of the city. Waiting rooms will be provided for the accommodation of the senders and receivers of messages. The latter will be delivered from substations or from the central station at a cost of five cents.

It is believed that under the new system the public will be better accommodated than ever before and that the cost of service will be reduced to the lowest point consistent with cost of maintenance.



Surface Contact Electric Railways.—II.[1]

BY EDWARD H. JOHNSON.

THE LEAK CIRCUIT.

THIS invention was the direct result of the frequent recurrence of a "live" section, consequent upon the leakage of current from the high potential button to the low potential or switch button, resulting in the maintenance of the magnetic switch in a closed position and a consequent "live" section after the car had passed instead of allowing it to open and clearing the section as it should.

By interposing the track rail, i. e., the negative conductor, between these two buttons, electric connection between them was made absolutely impossible except through the motor, hence a switch magnet could only be energized by the motor current, which is, of course, interrupted by the passing of the car—and never by the leakage current which, being independent of the car, remains as a source of evil. The importance of this provision against accidental electrification of the street, as well as its efficacy as a remedy, is acquiesced in by every one who has thus far considered the subject.

Fig. 6 will fully illustrate the manner in which the leakage currents are effectively guarded against. Upon examination of this diagram it will be noted that the magnet operating coils are contained in a circuit leading from the track rails to sectional rails placed outside of the same. As the current which energizes the magnets travels in a direction from the sectional rails to the track rails, it follows that any leakage from the sectional service conductors SC^1, SC^3, SC^5, etc., could never reach the outside sectional rails and cause a current to flow from said sectional rails to the track rails by way of the coils, all the leakage current necessarily being absorbed before it passes the negative track rails.

THE INTERCONNECTING FACTOR.

Experiments with the sectional rail system developed the imperative necessity for a "time allowance" for the operation of

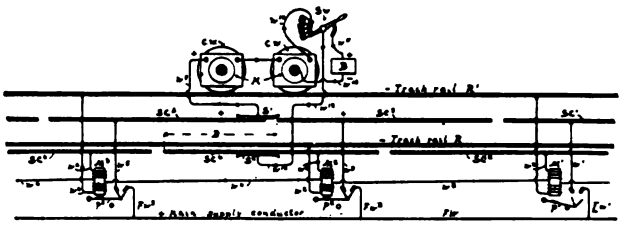


FIG. 6.

the switches before demanding current of the successive contact buttons or rails as the car progressed; this demand for time allowance is, of course, increased as the speed is increased. It is a fact that without such provision a car running 10 or 12 miles per hour would "run away" from the current—that is to say, the car would pass over a button so quickly that its switch would not have time to act and, consequently, the motor current not only failed, but destructive sparking at the switch contacts ensued. It is, of course, apparent that in the case of high speed trunk line roads this defect would be fatal. As to the efficiency of the means employed to give the requisite time allowance in a reliable and positive way, it needs only that the fact be stated that the current employed for actuating any given magnet is carried forward to and utilized in actuating the next succeeding one. If, therefore, the current employed is sufficient to energize the first, it must of necessity be sufficient for the next, thus ensuring the operating simultaneously with the first and not at some indefinite period thereafter.

The connection diagram, Fig. 7, will fully illustrate the manner of interconnections between the operating switch coils. For instance, the current will flow from sectional conductor SC^4 through wire W^4, through upper coil of magnet M^2, then by the interconnecting wire W^4 around the lower coil of magnet M^3 to the track rail.

MISCELLANEOUS FACTORS.

In the progress of development ensuing from the continuous chain of experiments conducted by us, many deficiencies not otherwise discoverable were made manifest. Among these were the following:

1st. The fact that the surface leakage from the high potential button to the track rails would suffice to keep the switch magnet energized if it were in the circuit between the main feeder and the high potential button. This led to a complete reconsideration of the electrical circuits. To remedy the difficulty the switch magnet was finally placed in circuit between the motor and the track rails, instead of between the high potential button and the motor, thus ensuring the absolute isolation of the switch magnet after the passage of the car. This was a new provision against the hurtful effects of leakage, as will be seen from this statement of its specific purpose and function, and quite different and apart from that provided for in the leak circuit.

2d. The fact that the interconnecting feature as originally worked out for street railway work would not operate with equal efficiency in both directions, and, therefore, though fairly satisfactory for street car work, would not at all fulfill the requirements of trunk line work; this led to its further consideration with consequent result of a circuit arrangement affording equally effective operation in either direction.

3d. The fact that when a motor attained a speed which caused

[1]Read before the N. Y. Elec. Society, Nov. 16, 1898, at the College of the City of New York.

Digitized by Google

its counter e. m. f. to approximate closely the direct e. m. f. of the line, the current passing would be so diminished in volume as to be insufficient to keep the switch magnets closed, thus producing an uncertain action with consequently dangerous fluctuations; this led to a consideration of ways and means to ensure a fixed minimum current through the switch magnet, independent of and indifferent to the quantity of current taken by the motor. The means finally introduced to effect this object proved upon trial to be positive and reliable in operation; without this provision, heavy traffic lines cannot be operated by a sectional conductor system.

Fig. 6, illustrating the leak circuit, will also clearly show the "by-path" feature. Upon examination of this diagram it will be noticed that the current for the motors flows from the positive main through the switch-contacts to a sectional conductor and contact shoe through the motors and to the controller where it divides itself—one part of the current flowing by way of the negative contact shoe and sectional rail to and through the switch coils, and finally to the rails or the return conductor; the other part flowing through a storage battery of low voltage—charging the same—to the car wheels and to the return conductor. It will thus be apparent that should the current through the motors diminish to any great extent, the current through the battery connection W^{11} will reverse and the battery will supply the additional current needed to safely work the electromagnetic switches.

THE CROSSING PROTECTOR.

Among the many, and sometimes captious criticisms which our work has met with during the period of its development, was one condemnatory of the use of a storage battery of material e. m. f. and current capacity and consequent cost and weight. We employed such a battery at the outset for the dual purpose of operating the magnetic switches and propelling the car over short distances; by the latter function obviating the necessity of electrically equipping crossings, switches, turn-outs and other situations otherwise involving not only expensive construction but great liability to interruptions consequent upon the possible short-circuiting of the conductors at such places. Although we presently gave ear to this criticism as one involving a prejudice not readily combatted, we, nevertheless, adhere to the opinion that such combination of battery and direct supply will yet be found to be an exceptionally economical and practical system of street car propulsion. However, having decided to concede the objection to be one deserving of our attention, we sought and found the means of dispensing with the battery, and at the same time overcoming the liability to interruptions in the event of short circuits. The means discovered for accomplishing this may be expressed in the paradoxical statement that though a short circuit may occur, and the safety fuse be blown, the current will yet flow in sufficient quantity to propel the car off the impaired section and permit its continuing progress without so much as an actual stoppage.

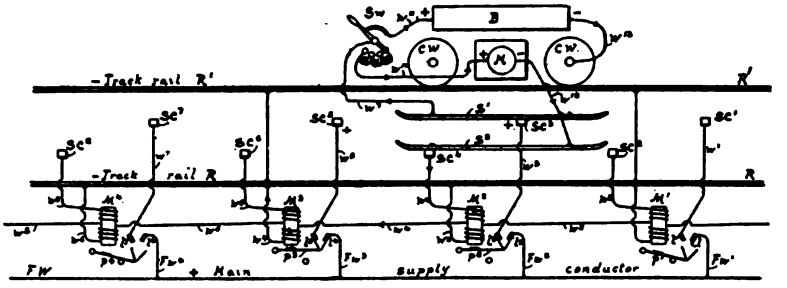


FIG. 7.

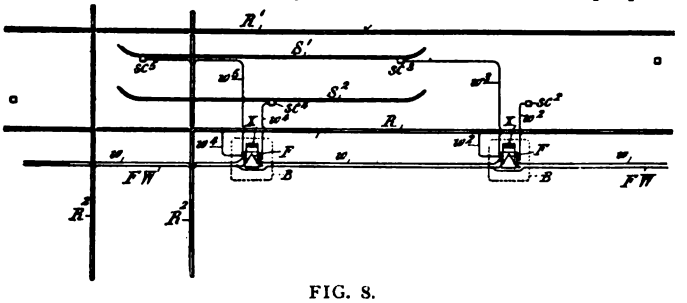


FIG. 8.

Such a provision is imperative in any surface contact system, since in any such system it is impossible to so differentiate the plans in which the positive and negative conductors lie as to render accidental short circuits improbable.

To illustrate this feature reference is made to Fig. 8, where S^1 S^2 represent the trolley shoes which are connected to the motor on board of the car (not shown); R^1 R^1 represent the tramrails of one line of rails and R^2 R^2 corresponding lines of rails of a crossing tramway. SC^2, SC^4, etc., represent one line of sectional trolley conductors or contacts, and SC^3 SC^5, etc., represent the parallel line of sectional trolley conductors or contacts. BB represent two of the switch boxes, the circuit connections from the current feeder or main thereto and therefrom to the sectional trolley conductors being identically like those described in the previous diagrams.

F represents the fuse in the switch box, which is designed to "blow" for such current as may be deemed best, and X represents a resistance in a shunt or derived circuit about the binding post to which the opposite ends of the fuses are connected, the arrangement being such that when any short circuit occurs between either of the trolley shoes, as S^1, one of the sectional trolley conductors SC^3, and one of the crossing lines of rails, as R^2, the fuse will be blown, but the circuit between the circuit connections in the switch box and that particular sectional trolley conductor or contact will not wholly be ruptured, and the sectional trolley conductor when connected through the circuit connections in the switch box will still carry sufficient current to move the car over the crossing to the next sectional trolley conductor in advance.

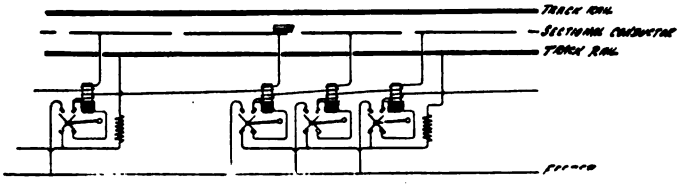


FIG. 9.—JOHNSON-LUNDELL SURFACE CONTACT SYSTEM, 1894.

Fig. 9 represents the Johnson-Lundell surface contact system of 1894. This should have been included in the early experiments illustrated in our last issue.

The Electric "Moto-Vehicle." [1]

BY C. E. WOODS.

FOLLOWING a very complete and interesting introduction giving the defence for the name "moto-vehicle" and the various types of vehicles manufactured as well as the present status of the art abroad, the author makes the remarkable statement that twenty thousand carriage makers are required to-day to fill the market demand for vehicles in this country as required for road and street transportation. A little over thirty per cent. of the total animal power used in this transportation is required in the cultivation of the soil to obtain fuel for this power and to transport such means of maintenance and stable refuse from point to point. This means, broadly speaking, that animal power has in itself but about seventy per cent. efficiency in its application. Further, horse power cannot be worked at a greater average than about five hours or twenty miles per day, which as compared with mechanical applications of any form puts such power into a very low figure of utility. Under such conditions of operation, this power unit has a depreciation of

[1] Abstract of a paper read before the Chicago Elec. Assn., Nov. 18, 1898.

Digitized by Google

not less than twenty per cent. per annum and from large users of horses in express companies, large liveries, etc., the depreciation has been given as about thirty-three per cent.—either of which figures is far in excess of any of our good mechanical or electrical propositions of the day.

These startling facts and figures bring us very close to an understanding of the possibilities in the moto-vehicle as an industrial feature, and we cannot under such circumstances deny the brilliant outlook it has for the future. The sanitary conditions attendant to its use, its lesser cost of maintenance, its greater mileage capacity, its more rapid transit, its lesser space occupied in the stable and on the street, its freedom from expense when not in use, all put together retire entirely the objections which at first appear as to its greater initial cost. The possibility this vehicle opens up for road and street improvement and the low cost of maintenance of same should be items of great interest to municipalities, counties and States. Streets will have a capacity for double the amount of vehicles without any increased congestion, will be freed from the continual pecking of iron feet, which are the main causes of their rapid deterioration, and sewers will perform their functions without being continually clogged up with refuse matter.

But to come back from speculation to reality. The greater first cost of these vehicles is a necessity which is very readily understood; as the vehicle part itself for the first item, is necessarily more expensive for the reason that when it comes to carrying twice or three times the weight in the vehicle ordinarily carried to running it twice or three times as fast as the horse-drawn vehicle under exactly the same conditions of road and street, it means quite a different proposition in vehicle construction without reference to its electrical and mechanical features.

I remember in my first early experience the disappointments which arose in regard to weights, constructional features, controls, etc., and three years ago I thought it would never be possible to build a moto-vehicle with any mileage capacity at all at a less weight than 1,800 pounds or 2,000 pounds, yet to-day I have vehicles in operation which weigh 800 pounds, including everything, and have a mileage capacity of about twenty-eight miles on one charge of the batteries. My work has also developed the fact that as great a range in different vehicles can be obtained as regards size, usefulness, etc., as in any of the prior lines of vehicles, and I have found that for a diversity of design covering nearly thirty different styles of vehicles, the whole proposition is confined to what I call four different sizes of equipments. By this I mean four different sizes of motors, batteries and so forth which are as follows:

My lightest vehicle is equipped with one 2½ h. p. motor, 36 batteries of sixteen ampere hour capacity for two hours which runs the vehicle at a speed of fourteen miles per hour, carrying two people. The weights in all the construction work of this vehicle have been reduced to a minimum, the total weight of the batteries being 440 pounds, about 360 pounds being in the motor and vehicle proper. To tabulate these different equipments will be the most concise way of putting them, and I will call my first equipment No. ½.

Passenger capacity, two; complete weight of vehicle, 800 pounds; weight of batteries, 440 pounds; average miles run on one battery charge, 20; speed, miles per hour, first, 3½, second, 7, and third, 14; number of motors used on vehicle, 1; horse power of same, 2¼; number of battery cells, 36; amperes per hour for three hours, 12; time in hours required to charge batteries, 3.

No. 1 equipment, designed for a top carriage or a heavy buggy: Complete weight of vehicle, 1,150 pounds; weight of batteries, 600 pounds; average miles run on one charge, 25; speed, miles per hour, first, 3½, second, 7, third, 14; number of motors used on vehicle, 2; horse power of same, 3; number of battery cells, 40; amperes per hour for three hours, 18; time in hours required to charge batteries, 3.

No. 2 equipment, which is designed for four passengers in an open vehicle such as a trap or brake: Complete weight of vehicle, 1,800 pounds; weight of battery, 800 pounds; average miles run on one battery charge, 30; speed, miles per hour, first, 3½, second, 7, third, 14; number of motors used on vehicle, 2; horse power of same, 5; number of battery cells, 40; amperes per hour for three hours, 30; time in hours required to charge batteries, 3.

No. 3 equipment, which is designed for both commercial delivery wagons and for my heavy cabs of which I have built quite a number, and is also applied to heavy carriages with tops, has a passenger capacity for from four to eight people: Complete weight of vehicle, 2,400 pounds; weight of batteries, 1,000 pounds; average miles run on one battery charge, 25; speed, miles per hour, first, 3, second, 6, and third, 12; number of motors used on vehicle, 2; horse power of same, 6½; number of battery cells, 40; time in hours required to charge batteries, 3.

The original calculation for one of the large cabs reads as follows: Maximum speed of vehicle, miles per hour, 12; total load to be carried, including four persons, 3,200 pounds; maximum horse power required in motors, 5½; average horse power required in motors, 4; voltage of motors, 72; volts lost in transmission in motor, 8; maximum voltage required, 80; number of cells required at two volts each, 40; maximum amperes required, 52; maximum amperes per motor, 26; average amperes per motor, 22; mileage capacity desired at maximum speed, 30; hours discharge required, 2½; ampere hour capacity required in battery, 2½ hours discharge, 110; greatest maximum effort required in motors for overcoming inertia and grade climbing, 9.

In accordance with these calculations from prior experience in smaller vehicles, I designed two motors of a nominal 3½ h. p. each, either one of which was capable of running the vehicle at a slight overload under normal conditions of level roadway. The tests of the cabs showed on a macadam and asphalt road a very little difference, and called, at the speed of twelve miles per hour, for 42 amperes with a potential of 72 volts at the motor terminals, which amounts to practically 4 h. p. In overcoming inertia the amperes would rise with a slight drop of voltage to 65, gradually diminishing until an acceleration of twelve miles per hour was reached, which acceleration consumes a period of about one-half minute.

There has been a great deal of controversy concerning the excessive weight of moto-vehicles and also considerable controversy by some of our theorists about what is considered dead weight and pay weight, and I want to say here that this limitation has not in my experience as yet been reached. We are perforce obliged to have weight for traction purposes, and many tests made by me on slippery roads, bad places, etc., have proved that with power applied to but two driving wheels we could not reduce our weight more than about 15 per cent. to 18 per cent. of what I have already obtained without being too light for good traction under all conditions of road.

I have also found a very wide difference in amount of power consumed in the use of rubber tires. I recently tried a new tire on the above named cab which consumed about 18 per cent. more power than the ones I am regularly using. I also, by very careful tests, have discovered that the hard rubber tire is far preferable to the pneumatic tire for use on moto-vehicles—and this without any refence to its first cost, durability, or freedom from puncture. The facts of the case are that the pneumatic tire absorbs more energy by about twenty per cent. when inflated, and by a very considerable increase over this as it may become deflated to different points of pressure.

The point of control has been a matter of considerable discussion by both those directly and indirectly interested in the development of the moto-vehicle. I have tried series paralleling the fields and I have also used series paralleling the batteries, after which I have adopted exclusively the series paralleling of the batteries as my method of installation. The one thing to be observed is to have very large contacts and connections and to take the same pains in the distribution of the batteries when in parallel as one does in the distribution of current in the armature. In other words, a uniform resistance of the circuits of the different batteries will produce perfectly satisfactory results in their operation, which I do not find to be the case in series paralleling the fields. This latter can be done to such an extent that but a small rise of current would be made in overcoming inertia but the excessive amount of field winding will oversaturate the fields unless they are unnecessarily large, and tends to a very considerable loss of voltage in dead resistance; and while we economize in current, we do not economize in energy as in the case of series paralleling the batteries.

Three speeds I have found to be sufficient for all practical purposes, even on our congested streets, and now have my motors running in parallel entirely independent from one another in their propelling function. Fourteen miles per hour for the larger vehicles I have found to be about the practical limit, as the amount of momentum stored up in the given weights of the vehicles cannot be brought under control by brake application

Digitized by Google

quick enough to be safe on our city streets at greater speeds. In other words, we cannot brake on the moto-vehicle any more than we can on the car, beyond the locking of the wheels. In the light road buggy which I have, I have geared it up to twenty miles an hour, and find that with 800 pounds I can handle it with a reasonable degree of safety on boulevards and parks, but I do not recommend these speeds to go any higher as a general proposition; although as a racing proposition, I believe that the moto-vehicle will be brought down to 1½ minutes for a mile, or perhaps even less time.

The New Heilmann Electric Locomotive.

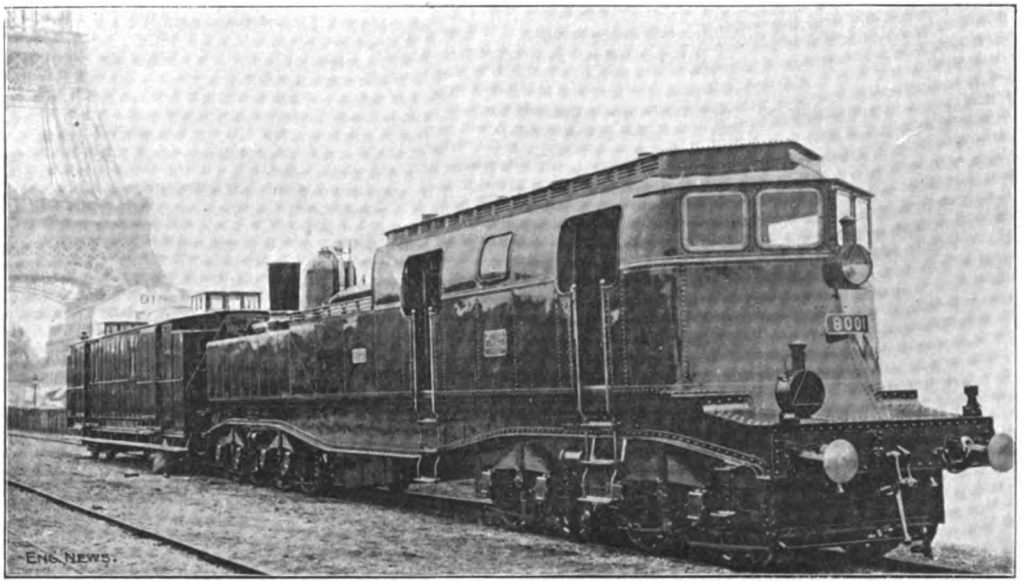
THE self-contained electric locomotive invented by Mr. J. J. Heilmann, which since its introduction a trifle over five years ago, has been the subject of considerable discussion as to its merits and the advisability of placing the electric generating plant on wheels, has during the past years been vastly remodeled and improved by the inventor. It will be remembered that in 1896, two machines of improved design were built by the Heilmann Works, and were tried on the Western Railway, in France. The results of these trials, however, have never been made public.

The latest design turned out by the Heilmann Works, is the one shown below, and for which we are indebted to the "Engineering News," to which journal Mr. Dronin, the engineer of the works, has sent the following details:

The new 120-ton locomotives are 61 feet long over the frames, 8 feet 10 inches wide over all, and 13 feet 9 inches high from the rail to the top of the smokestack. They have a total wheelbase of 50 feet 6 inches, the truck wheelbase being 13 feet 6 inches. The boiler is of the locomotive type, with Belpaire firebox, and is fixed at the middle, the ends being supported on expansion bearings. It has 351 tubes, 1¾ inches diameter and 12 feet 6 inches long. The grate area is 36 square feet, and the total heating surface, 1,995.6 square feet, of which latter the interior surface of the tubes represents 1,818.4 square feet. The coal bunkers are on either side of the boiler, and the water is carried in a tender, as in previous types. The engine is of the Willans vertical compound type, having six sets of tandem cylinders (or twelve cylinders in all), the high pressure cylinders being 12 by 16 inches, and the low pressure cylinders 19.2 by 16 inches. This engine runs normally at 400 revolutions per minute, the cranks running in a closed chamber containing oil and water. A separator on the steam pipe prevents water from getting into the cylinders.

At each end of the engine shaft is a six-pole dynamo, furnishing a current of about 1,000 amperes at 450 volts, or of double that intensity for a brief time. These dynamos are coupled in parallel. They are enclosed in steel casings, having suitable manholes and openings for ventilation. They were built by Brown, Boveri & Co. The exciting dynamo is a four-pole machine, which also serves to light the train, furnishing a current of 140 amperes at 115 volts. It is driven by a two-cylinder simple Willans engine of 28 i. h. p., having cylinders 8.64 by 5.08 inches, and running at 550 revolutions per minute. On each driving axle is mounted a four-pole motor, rated for 125 h. p. (or 1,000 h. p. in all), at a speed of 62 miles per hour.

The machine is said to ride very steadily, owing to the absence of the ordinary reciprocating parts and to the balancing of its multi-cylinder vertical engine. Although it can develop considerable power, it does not seem capable of hauling very heavy trains, or of attaining any exceptional speed. One advantage claimed is an economy in coal consumption, but the information furnished us gives no particulars of any work in hauling heavy trains. An engine of 120 tons, with a huge tender in addition, ought to be able to do some real work, but we have no information as to the character of the tests or results obtained.



VIEW OF THE HEILMANN ELECTRIC LOCOMOTIVE AND ITS WATER CAR ON THE WESTERN RAILWAY OF FRANCE.

Electric Railroading in Japan.

The second electric railway undertaking in Japan is the Hoshu Electric Railway, which will run from Beppu to Oita in Kyushu. Work was suspended for a while, owing to financial difficulties, but these have now been overcome and the construction is steadily advancing. The contract for all the materials was let to the Saiga Electric Company of Kyoto. The company has made the following purchases: Two Lancashire type boilers of 160 horse power each (made in Japan), one 160 horse-power McIntosh & Seymour high-speed engine; one six-pole, 160-kilowatt General Electric Railway generator; ten No. 21 Brill trucks and twenty 25-horse-power railway motors. A good part of this material has already been forwarded and considerable is yet to go. The engineers in charge of the work are H. Maki and T. Saiga, both officers of the company.

Proposed Electrical Consolidation in Baltimore, Md.

Efforts are being made to combine the three electric light companies of Baltimore into one corporation. If the plan should succeed bonds will be issued to cover the entire property and to provide for the building of a large modern electric lighting plant. The companies included in the deal are the Brush Electric Company, of Baltimore City; the Northern Electric Company and the Edison Electric Illuminating Company. The negotiations looking to the consolidation of the City Passenger Railway Company and the Consolidated Street Railway Company will, it is thought, culminate in the purchase of the former by the latter. About $12,000,000 would probably be involved in the deal and $1,000,000 or more would be expended in immediate improvements, including the change of some cable lines to electricity.

Digitized by Google

The First Train of Bonner Rail Wagons.

IN our issue of Aug. 18, 1898, we gave a full description and a number of illustrations of the Bonner rail wagon, which seems to have solved the problem of the short haul freight traffic. It is, in brief, a vehicle adapted to be used upon an ordinary roadway or upon a railway track, or to be shifted from the one to the other at will, without the necessity of reloading or rehandling the freight carried, from point of shipment to its destination. Electricity substitutes animal power when the vehicle is moved on rail tracks, consequently it radically reduces time and cost of transportation for city, suburban and inter-urban traffic.

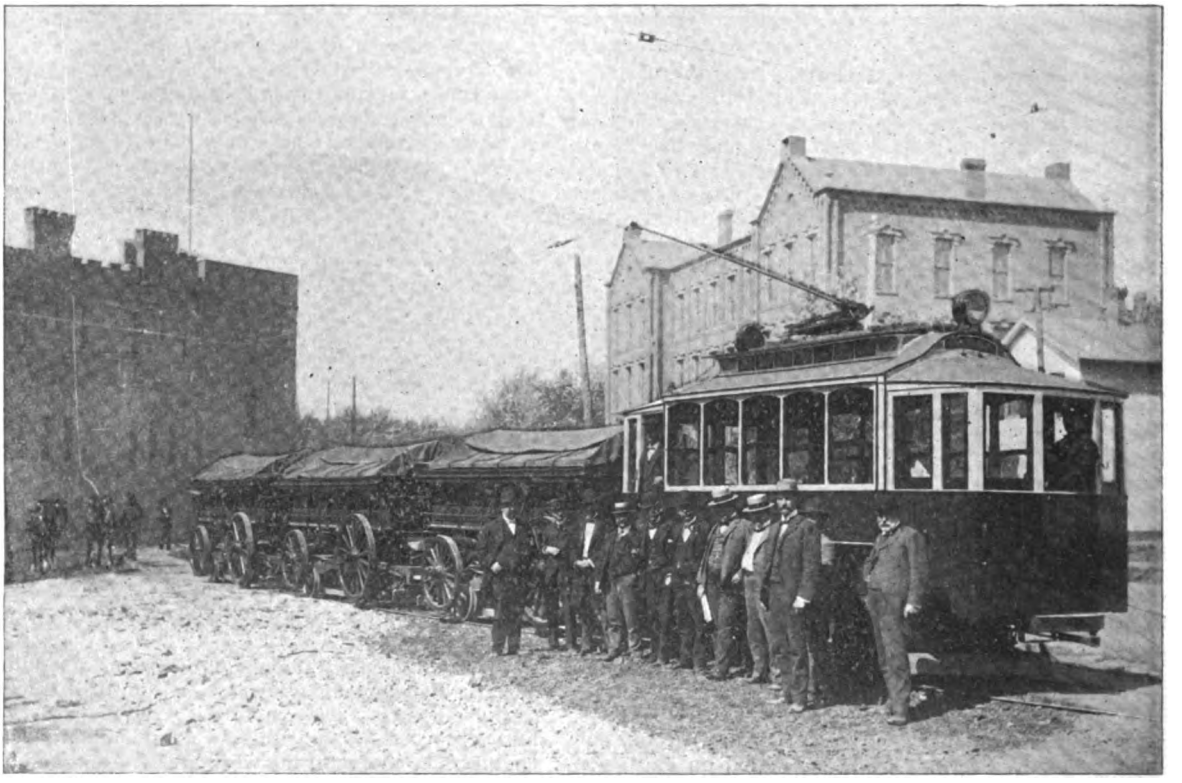
The Bonner Rail Wagon Company, organized for the purpose of building and introducing the inventions of Col. Joseph C. Bonner, has had a daily train service out of Toledo on two suburban roads, for the past few months. The Toledo City Council, on Aug. 8, 1898, passed an ordinance granting the Bonner Rail Wagon Company the authority to make an agreement with any street railway company whereby rail wagons are privileged to run upon the street car tracks of the city for such terms and compensation as agreed upon with the Toledo Traction Company. The first train of wagons, illustrated below, was run over the lines during the early part of September, and the success of the trip can be judged from the following gratifying account in the "Toledo Daily Blade" of Sept. 8:

The Bonner rail wagon is a success. The public demonstration of the new wagon was made this morning over the streets of Toledo and, while the first train plowed through the streets, pedestrians stood agape with wonder, shoppers ran from the stores, and the ever-present small boy hung on the running gear and shouted his appreciation to less fortunate companions on the walks. It was the first time the people of Toledo had seen the rail wagon, and, for that reason, Col. Bonner was anxious that the appearance should be perfect in every respect. A special motor car, designed by the Traction Company, was placed at the head of the train, consisting of three rail wagons, and this motor pulled the train from Perrysburg.

At Perrysburg, the train was standing at a siding, awaiting the motor, and Col. Bonner took occasion to explain some of the points to the visitors. He showed them how the wagons were unloaded from the trucks and how they were again loaded by reversing the former operation. The mechanism of the wagon was fully explained, also the system under which the company expects to transact its freight business. All packages will be carried at the rate of ten cents a hundred pounds, with a special rate for rail wagon loads. The company will have regular schedule time for through trains to outside towns, and will do a general freight business in traffic which is too small for the railroads to handle advantageously.

Coming down from Perrysburg many of the party rode on the rail wagons, and found them a most comfortable place. The rail wagons are all of the heavy spring variety, but there was little oscillating motion while on the trucks, not enough to injure the contents while in motion. The rail wagons are quickly transferred from the rails to the street, and inside of four minutes after arrival in the city the loads are ready for delivery.

The terminus of the company is near the armory, where planes have been erected to load and unload the wagons. The train was run to this point, where two of the wagons were taken from their trucks and pulled to the street by horses. During the trip nothing occurred to shake the faith of the promoters of the rail wagon, and in their opinion the test was highly satisfactory.



FIRST TRAIN OF BONNER RAIL WAGONS AT TOLEDO, OHIO.

Data from Poor's Manual of Railroads for 1898.

THE splendid collection of railroad data known as Poor's Manual has again made its appearance, and is, if possible, more valuable than ever. The street railway section is remarkably authentic and complete. In view of the general interest of electrical engineers in the equipment and operation of steam railroads by electricity, we give the general data furnished by the compilers:

	1897.	1896.
Miles of railroads	179,692.57	178,549.33
Miles of track	236,911.52	235,482.79
Locomotive engines	35,810	36,080
Cars, passenger	25,275	24,788
Cars, baggage, mail, etc.	8,133	7,839
Cars, freight	1,229,335	1,240,061
Total revenue cars	1,262,743	1,272,688
Capital stock	$ 5,453,782,046	$ 5,290,730,567
Bonded debt	5,411,058,525	5,426,074,969
Unfunded debt	374,389,673	339,502,302
Current accounts	392,481,496	386,382,440
Total liabilities	$11,631,711,740	$11,442,690,278

Digitized by Google

	1897.	1896.
Excess of assets over liabilities ..	299,901,913	364,806,935
Totals	$11,931,613,653	$11,807,497,213
Cost of R. R. and equip.....	10,029,151,607	9,963,767,710
Real estate, stock bonds and other investments	1,509,841,062	1,450,418,025
Other assets	222,089,700	231,915,121
Current accounts	170,531,284	161,396,357
Total assets	$11,931,613,663	$11,807,497,213
Miles operated	181,132.70	180,891.19
Rev. train mileage:		
Passenger	342,464,408	337,641,115
Freight	500,326,372	497,248,296
Mixed	15,235,049	15,785,433
Totals	858,026,179	850,674,844
Passengers carried	504,106,525	535,120,756
Passenger mileage	12,494,958,000	13,054,840,243
Tons freight moved	788,385,448	773,868,710
Freight mileage	97,842,569,150	93,885,853,634
Earnings:		
Passenger	$253,557,936	$265,313,258
Freight	780,351,939	770,424,013
Miscellaneous	89,636,791	89,894,754
Totals	$1,123,546,666	$1,125,632,025
Net earnings	338,170,195	332,333,756
Receipts from other sources.....	95,013,907	104,007,542
Total available revenue	$433,184,102	$436,341,298
Payments:		
Rentals, tolls, etc.	$58,600,768	$59,081,058
Interest on bonds	231,046,819	242,415,494
Other interest	5,633,298	7,996,456
Dividends on stock	82,630,989	81,364,854
Miscellaneous	28,124,474	34,233,688
Total payments	$406,036,348	$425,091,550
Surplus	27,147,754	11,249,748

For the whole country the average freight ton rate per ton per mile was 7.98 mills, as compared with 8.21 in 1896. The average passenger rate was 2.029 cents per mile, as compared with 2.032 in 1896, and the average passenger train load was 36.49 passengers, a decrease of 2.17 from 1896. It will be observed that, while the total freight earnings increased nearly 10 millions (1.29 per cent.), the passenger earnings decreased over 11¾ millions (4.43 per cent.). The total gross earnings show a slight decrease, $2,085,359, equal to one-fifth of 1 per cent.

The average freight train load increased from 180.81 in 1896 to 195.56 in 1897.

The total gross and net earnings per mile of road and average dividends, etc., were as follows:

	1897.	1896.	1895.
Gross earnings	$6,203	$6,223	$6,097
Net earnings	1,867	1,837	1,804
Per cent. of expenses to earnings	69.91	70.48	70.41
Dividends paid on total stock, per cent....	1.52	1.54	1.58
Interest paid on total bonded debt, per cent.	4.27	4.47	4.24

High Voltage Power Transmission.—II.[1]

BY CHAS. F. SCOTT.

RUNNING TESTS AT TELLURIDE.

THE first tests were qualitative rather than quantitative. It was uncertain what phenomena might accompany the operation of a long line at high voltage, and the pressure which could be used on the insulators was a matter to be determined. The first thing was to find what would work; measurements could be made afterwards. A high voltage was placed on the transmission line, sometimes transmitting no power and at other times operating the 100 h. p. synchronous motor. In December, 1895, the motor was operated at 25,000 to 33,000 volts for several days. In January, 1896, 45,000 volts was used continuously for over a week, and beginning with the latter part of March a continuous run of 37 days was made at 50,000 volts.

Some measurements upon the line were made by determining the power to the raising transformers when the lines were connected and when they were disconnected. These measurements showed that the loss due to the line is small, below 45,000 volts, but increases rapidly when about 50,000 volts is exceeded, and reached 16.4 k. w. at 59,000 volts.

The record of the operation of this line at 50,000 volts for over a month, given in the form of curves, is of very great interest, as it is a practical demonstration of the feasibility of operating a line at 50,000 volts, a pressure four or five times as great as any which had been in general commercial use. Mr. V. G. Converse had been up to this time closely associated with this work. He had much to do with the design and construction of the high-tension transformers and insulators, tests upon losses in lines made at the Pittsburg laboratory and the tests at Telluride.

MEASUREMENTS AT TELLURIDE.

The work at Telluride was then taken up by Mr. R. D. Mershon. The facilities for experimental work were increased and instruments were provided for carrying on the tests. Mr. Mershon found peculiar difficulties in making exact measurements of the power to the circuit. A wattmeter in the low-tension circuit of the raising transformer led to errors under the conditions which prevailed. Some very able and painstaking work was displayed in detecting the error and overcoming it with the facilities at hand—and the facilities were none too plenty in the heart of the Rocky Mountains for making measurements which would tax the resources of almost any laboratory. The apparatus used introduced a disturbing influence in the circuit, which, however, could be measured and eliminated. On the other hand, a wattmeter for measuring power on a high-tension circuit must accommodate a very high voltage and a very small current. As the charging current to an open line is usually very large in proportion to the loss current, the error in the instrument is very sensitive to slight variations of phase in the shunt current. The results of the measurements and the conclusions are given partly by extracts from Mr. Mershon's report, and partly in abstract.

RESULTS OF MEASUREMENT.

"The results of measurements taken are embodied in curves.

"In every case the measurements were taken upon an open-circuited line—in no case upon a line which was transmitting power. The line losses obtained are therefore a combination of those occurring between the line wires and the very small $I^2 R$ loss in the wire itself due to the charging current of the line.

"There were two generators used. One was that regularly running and supplying power to the power circuits of the Telluride Power Transmission Company. It is a 600 k. w., 22-pole, quarter-phase machine, delivering 500 volts at a frequency of 60, or 7,200 alternations per minute. Its armature is of the slotted type and is wound with copper bars. In the notes this generator is designated as the 'Slotted Armature.'"

"The other generator is one whose field is that of the 100 k. w. toothed armature machine, originally sent out as a part of the first Gold King transmission plant. It has twelve poles and as originally run operated at 3,000 volts and 10,000 alternations. There are two armatures for this machine; a surface wound armature, designated at 'Smooth Armature,' and a toothed armature, designated as 'Toothed Armature.'"

Comparison Between Insulators.—A set of measurements was made for comparing the loss on the three circuits supplied respectively with large glass, small glass and porcelain insulators. The curves are very nearly identical and correspond very closely with the right hand curve in Fig. 1. "There was a heavy wet snow on the ground and the cross-arms at the generating station and more or less snow all along the line; that at the further end being drier than at the generating station. There was more or less snow falling during the measurements, and this accounts for a wide variation of the points taken at the high voltages, as falling snow renders the wattmeter reading very unsteady, the unsteadiness being such as one might expect if from time to time there was a discharge between the wires. This unsteadiness does not seem to be as great in the case of falling rain as in the case of falling snow."

Loss and Distance Between Wires.—A series of measurements was made to determine the connection between the loss and the

[1]Abstract of a paper read before the 15th general meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

distance between wires. "As at that time it had not been fully demonstrated that the loss was not affected by weather conditions except there was precipitation, changes in distance between wires were made upon one circuit, while the distance between wires on another circuit was maintained always the same, and the latter was used as a reference circuit when a change in loss was obdinate."

The several curves have been plotted together, due correction being made for the slight difference in the loss in the reference circuit, which probably resulted from slight differences in the precipitation when the curves were taken. The distance between the wires in the several tests was 15, 22, 35 and 52 inches respectively. The results are shown in Fig. 1. It will be noted that the loss is much greater when the wires are close together and that the curve begins to ascend at a lower voltage.

Comparison of Wattmeters.—The loss curves were taken on one of the circuits, first, with the Weston wattmeter and then with the Thomson wattmeter. The Weston wattmeter was not in circuit when the measurements with the Thomson wattmeter were taken. As an additional check, the readings were taken on each of the wattmeters of the loss occurring in the shunt resistance of the Thomson wattmeter the results were in practical agreement with each other and with those obtained by calculation. The discrepancy in the results obtained on the two instruments when measuring line loss will be referred to later.

Loss on Insulators.—A set of comparative readings was taken on one of the circuits and on a dummy circuit, identical with the main circuit, as regards kind and number of insulators, and the size of wire, but only 60 instead of 11,720 feet in length. The results show that the loss on the two circuits is practically identical up to about 50,000 volts, which is the part of the curve below the bend. The losses agree closely with those shown in Fig. 1. At higher voltages the loss on the dummy circuit increased slightly, indicating that the loss was of the same nature as that at a lower voltage. The agreement of the loss on the two lines at low voltage indicates that this loss was over the insulators. The great increase in loss on the long line at high voltage indicates that the loss was due, not to the insulator, but to the line.

Resistance and Reactance in the Circuit.—Measurements were made with resistance between the generator and the raising transformer, then with reactance and then with neither resistance nor reactance. The results are shown in curves, and indicate a different condition, depending upon the character of the circuit supplying the current. It was presumed that this difference arose from a modification of wave form of the e. m. f. applied to the line.

Wave Form and Loss.—Measurements were made upon the wave form and the corresponding losses when different generators were used and different circuits were connected. In one test an armature giving nearly a sine wave was used which delivered currents at 30 cycles. Measurements were made upon one circuit only, and then upon two circuits in multiple. The wave form for no load and for both conditions of load are given in Fig. 2. The current taken by the two circuits in multiple is twice that by a single circuit. The variation from a straight line in one of the current curves is due to a change in wave form as the voltage is increased. The loss for the two circuits in multiple is about twice as great as for one circuit at low voltages, but it is less than that for one circuit at high voltages. Referring now to the wave form taken at high voltage, it is seen that the wave form for the two circuits in multiple has a lower maximum than that for one circuit alone. The reduced loss on the two circuits is undoubtedly due to the different wave form when both circuits were connected. The distortion of the wave form is due to the reaction which the leading current produces in the generator and transforming apparatus.

Wave forms were also taken on the slotted armature giving 60 cycles. The wave forms are given in Fig. 3. The conditions are similar to those just described, in that a single circuit produces a wave having a much higher maximum than that produced when two circuits are run in multiple. The losses (which are not shown) bear the same general relation as that in the last case, namely, the loss with two circuits is greater at low voltage and at the high voltage is less than that on a single circuit.

A wave form was taken upon the toothed armature both at no load and also when supplying current to one of the circuits. This wave differs radically from a sine wave at no load and is greatly distorted when supplying a leading current. In the no-load wave the value of the fundamental is 72.5 per cent.; the third harmonic 21.6 per cent.; the fifth harmonic 4.8 per cent. The distorted wave makes the Thomson wattmeter read too high, especially at the lower e. m. f's.

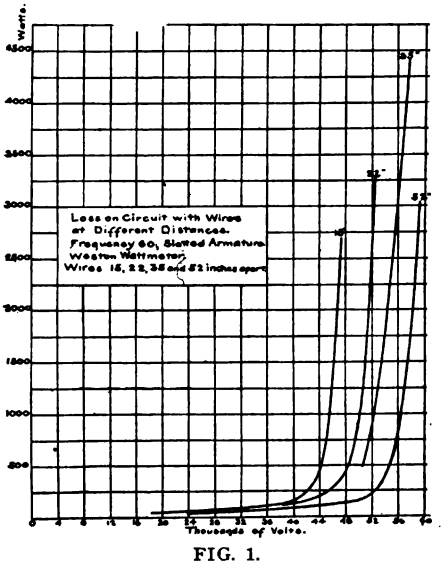


FIG. 1.

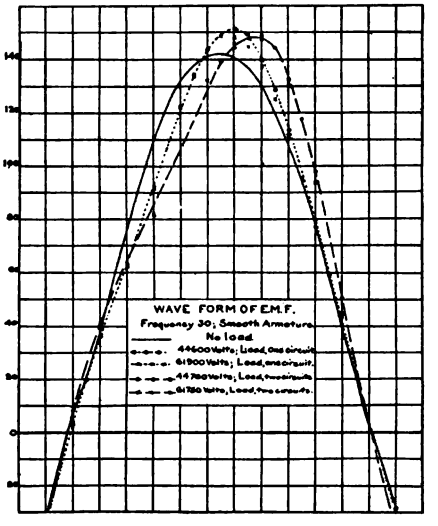


FIG. 2.

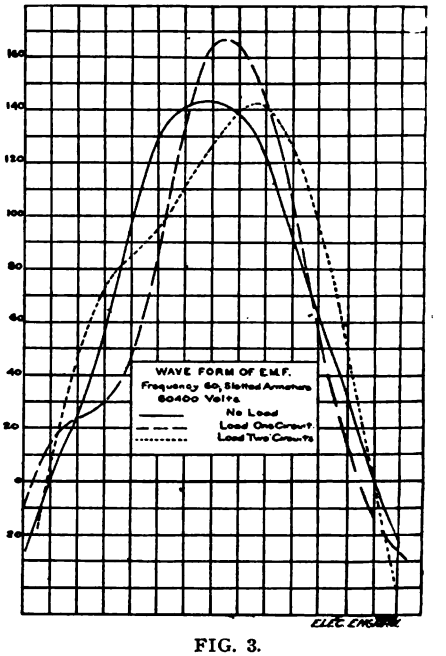


FIG. 3.

OTHER OBSERVATIONS AND TESTS.

"A series of observations were taken extending over a period of thirty-three days, to determine whether there was any connection between the loss occurring on the lines and the variations in weather conditions. Three readings were taken each day. They were, in addition to the wattmeter readings, readings for barometric pressure, temperature, humidity, wind direction and wind velocity. The weather observations were taken simultaneously at Ames and the King, using sets of weather instruments furnished by the United States Weather Bureau.

"The results of all measurements taken during this work seem to confirm the fact that the only weather condition whatsoever which affects the loss to any practical extent is that of precipitation. The loss seems to bear some relation to the size of the particles precipitated, being greater for a fall of snow in which the flakes are large than one in which the flakes are small.

"In the power transformers used, the series reactance was comparatively small because of the subdivision of the coils. A change in the condition of the line as regards loss occurred when the Weston wattmeter was placed in circuit. This was detected by measurement upon the Thomson wattmeter, both when the Weston wattmeter was in circuit and when it was not. Moreover, the lines hissed when the voltage is 55,500 and the Weston

Digitized by Google

wattmeter is out of circuit, but when the Weston wattmeter is thrown into circuit the hissing ceases, although the voltage rises to 57,700. The hissing sound is a characteristic of high-voltage lines and begins at the bend in the loss curves. It always accompanies luminosity of the lines.

"Along with this change there was another phenomenon not previously mentioned. This was a discharge which took place from time to time between the terminals of individual choke-coils. The discharge would occur sometimes between the terminals of one choke coil and sometimes simultaneously on two or three of the choke coils. These discharges made considerable noise, sounding very much like a pistol shot, and could be heard at a considerable distance from the transformer house. As the choke-coil terminals are distant from each other about 8¼", it is not thought that this discharge took place through the air, but over the surface of the wood enclosing the choke-coil. The discharge, however, left no mark on this surface. Simultaneous with these choke-coil discharges one could hear, if standing under the line some little distance from the transformer house, a slight snap which seemed to be a phenomenon rather of the whole line than of any particular spot in it. Sometimes there was a corresponding snap over the lightning arresters. As the lightning arresters make more or less noise at all voltages, this snap over them may have been present at all times, but in some cases not sufficiently well marked to be heard above the continued hissing of the lightning arresters.

"After the preceding results had been obtained, the two power transformers were connected up with their high-tension windings in series, the point of connection between them being grounded, and with their low-tension windings in multiple. With this arrangement voltage was impressed on one of the circuits, power being supplied by the smooth armature at 7,200 alternations. The voltage was run by means of the machine field to 90,000.

"As the power taken by the lines at this voltage overloaded the motor used to drive the generator, a span was cut out of the circuits at a little distance from the station, leaving about 500 feet of wire in them. The voltage was run up to 133,000 volts and held there for some minutes; but the current finally jumped from the outside terminal of each transformer to the iron, smashing the heavy glass tube with which these terminals were insulated."

RÉSUMÉ AND CONCLUSIONS.

"It is undoubtedly true that the loss is made up of a loss over insulators and a loss between wires, and that the latter is the only loss worth considering.

"The loss between wires is not affected by any atmospheric conditions except precipitation. This statement of course must be taken as applying to such a climate as that in which the measurements were taken. The lines were seldom in fogs or clouds, and when they were, or when rain was falling, the moisture was of the purest. Near cities the loss would be undoubtedly much greater than that shown in these curves, because of the impurities both in solution in the moisture of the atmosphere and in suspension.

There will be for a given transmission a certain economical voltage, because while an increased voltage, with a given line wire, will reduce the loss in this wire by decreasing the transmission current it will also increase the loss between the wires.

"It is believed that attention to wave form is very important. The sine wave is undoubtedly the best as giving a stable form, and because of superior results with all kinds of apparatus. A flat wave would of course give less loss, but would not be stable, and as the nearest practical approach to a sine wave, will not be perfectly stable but will still contain some harmonics, it will be of advantage to keep the series reactance of the transformers and generators as low as possible.

"It is believed that 40,000 volts is perfectly conservative and safe as regards loss between wires for any ordinary good wave form, and in a climate such as that in which the measurements were taken, i. e., where the air and precipitated moisture are practically pure, 40,000 volts come well below the bend in the loss curve even under the worst weather conditions.

"I can see no advantage of porcelain over glass, unless it be that of superior mechanical strength. The latter is rather a doubtful advantage. The ball from a heavy calibre rifle or revolver such as are used in the Western country will smash any insulator whether glass or porcelain. Porcelain offers a more tempting mark, being white. As to hygroscopic properties, no difference could be discovered so far as these measurements were concerned. It will make little difference under running conditions whether the insulator be hygroscopic or not, as the small amount of power necessary to keep the surfaces dry will be insignificant. I say under running conditions, because in starting up a 'cold' line there is danger of break-down if current is put on suddenly at full value, instead of being raised gradually. As far as the resistance to piercing is concerned, glass is just as good practically at least as porcelain. It needs no electrical test to pick out a good glass insulator, which is one advantage of glass over porcelain.

"To sum up, glass insulators are cheaper, lighter, more easily tested and less likely to be shot at than porcelain; on the other hand, they have less mechanical strength.

"In every case, in my experience, where a break-down has occurred, it has been on a cross-arm which was 'wind shaken' and 'weather cracked,' the current following the cracks. This leads to a curious result. The mark of the current will be on the surface of the arm for five or six inches, then disappear from the surface altogether for some inches, then reappear, etc. On cutting open the arm one sees how the current has followed the best path, dodging in and out. Rain and moisture probably settle towards the cracks, carrying salts from the body and surface of the wood. This forms a path of low resistance, especially in wet weather. For this reason I have in the plant of the Colorado Electric Power Company taken particular pains in treating both pins and cross-arms. The cross-arm treatment is such as fills all cracks and fissures as a section of the wood shows.

"This report would be incomplete without an acknowledgment of the assistance rendered in the work by the engineering force of the Telluride Power Transmission Company, headed by Mr. P. N. Nunn. Especial credit should be given Mr. A. L. Woodhouse for his faithful work and constant perseverance in the face of great discouragement."

NEWS & NOTES

Proposed Combination of Leading Electric Elevator Interests.

As we go to press, the following special dispatch from Trenton, N. J., of Nov. 28, notes a proposed "deal," of which rumors have been afloat for some little time. Further details are not obtainable at this hour. It is understood to relate to elevator patents, prices and division of the elevator business:

The combination of the manufacturers of elevators and hoisting apparatus, including the Otis Elevator people and the Sprague Elevator Company, and the various other elevator interests, filed its certificate of incorporation this afternoon in the office of the Secretary of State, under the name of the Otis Elevator Company.

The object of the company is to manufacture elevators, hoisting apparatus, engines, dynamos, generators, pumps and machinery. It has power under its charter to hold real estate, to acquire the business of any other firm or company, and to do business in any part of the United States. The directors are divided into two classes, elected by the preferred and common stock, respectively, and the directors elected by the preferred stock hold office for two years. The company is capitalized at $11,000,000; $4,500,000 preferred and $6,500,000 common stock.

The certificate of incorporation does not follow the usual line of combinations in giving the directors controlling powers, but in the Otis Elevator Company the stockholders hold the control in all matters of importance. The directors are forbidden to execute mortgages or liens upon the property without the consent of two-thirds of the stockholders. They are restricted in disposing of or acquiring property without the consent of the stockholders. The company is authorized to employ its surplus in the purchase of its own stock or the stock of other companies.

The certificate of incorporation is apparently drawn with great care, and with a view to avoid conflict with the laws of other States respecting combinations, and in this respect is different from most of the trust certificates heretofore filed. The subscribers for the capital stock of the company who signed the certificate of incorporation are James B. Dill, Leighton Calkins and Albert Sprague Bard, of New York City.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1893.]

Vol. XXVI. NEW YORK, DECEMBER 1, 1898. No. 552.

The Agitation Over Street Car Brakes.

EVER since the cry was raised a few years ago against the deadly trolley, denouncing it as the greatest modern exterminator of the human race, until now when it is welcomed by all civilized communities and suburban residents as the greatest boon to land owners and farmers, large families and manufacturers, The Electrical Engineer and others have been doing their utmost to convince the public that the current employed was perfectly harmless to human life. However, accidents were frequent and were alleged to be increasing day by day, the reverse of what might be expected as the motormen became more expert in the control of the cars. Soon there came a large increase in speed and weight of moving mass and, in the words of a daily paper, "the public attention has again been sharply attracted to the perils of electric traction for street cars by the alarming frequency of accidents on the newly opened lines in New York." Lamentable as this state of affairs certainly is, we may well rejoice over the improved condition of the public mind in passing judgment on "so terrible a calamity," and in laying the blame not on the dangerous "fluid," but rather on the braking mechanism on the cars, the heedless passer-by and the inexperienced brakemen. Believing ourselves that all three of these conditions are responsible for the frequency of accidents, we have yet to learn of a method of educating the public sufficiently to make them understand that rapid transit by surface cars means also a more rapid movement of persons across the tracks. They are slow in coming to see that the nearness of a fender is significant of greater danger than the grazing of one's shoulder by the head of a horse; that an electric car going at full, permissible speed cannot dodge a wagon suddenly thrust in front of it, nor protect a child which, unguided and unprotected by its parents, suddenly steps on the tracks.

These also are some of the trials and tribulations of the motorman, who, watchful of the signals of the conductor, with one hand on the controller and the other on the brake, has to feel his responsibility increased by the recklessness and thoughtlessness of pedestrians and drivers, not to mention the bicyclists and children. Aside from this mental strain, his physical strength is taxed to the utmost by the effort of applying the brakes from 250 to 400 times a day, no easy task when each time a twenty-eight-foot car, weighing about twenty thousand pounds without passengers, going at a speed of, say, ten miles an hour, has to be brought to a standstill within a space of less than its own length.

"Hand Brakes versus Power Brakes" is a subject of great antiquity, but one on which opinions have been largely reversed on account of the changed conditions. Formerly, when small, light, easily manageable horse cars were in vogue, the hand brake required but a respectable portion of a man-power to bring the car to a stop. But to-day when speed and weight have been so largely increased as to make surface cars approximate steam cars, the hand brake of old appears inadequate and wasteful of human energy. Something more powerful and quicker in its action is demanded or else another person on the platform whose sole duty it shall be to brake the car. A multiplicity of operators, however, like a multiplicity of parts or operations, is always inefficient and unreliable and we are, therefore, thrown back upon the first alternative, the power brake. And this presents an equally difficult question, and one which, perhaps, is responsible for the present condition of affairs, namely, the kind of power to be used. There are at disposal compressed air, so well known as a braking agent; the current itself, which can be used as a magnetizing agent, or by having the motor act as a generator and reverse the motion of the car; numerous hydraulic brakes, which have been proposed and tried, and even the inevitable spring which has been called into account.

Of the first named type, we only need to refer to the well known Westinghouse air brake, so largely used on our steam roads, as well as the Standard and Christensen air brakes adopted for street railways. It certainly appears as if some one of these brakes, regardless of their expense and complicated construction, as well as their greater liability to fail than hand brakes, would fill the long-felt want of street railway companies and the public.

Of the second, electric class, there is the Sperry electric brake, which has given excellent service, and a number of other electric and magnetic brakes proposed since 1894. There certainly appears no reason why the ability to reverse the motor should not be used as an additional safeguard, no matter what other means are employed to brake the car.

This compilation of methods proposed, tried, approved and in part rejected, would be incomplete without making mention of the numerous hydraulic brakes which from time to time have been placed on cars though seldom on the market. We recall at this moment the test made in 1896 on a car in Brooklyn equipped with the Lombard hydraulic brake, which performed the following remarkable feat: With a 32-foot car, running at about 8 or 9 miles an hour, the car was easily stopped within 6 or 8 feet. Why has that not come into use?

In fact, as we look back over the literature of car brakes, we find that nearly every test made with the various types of brakes was highly successful and gave great promise for the future. But now, when the time has come for the immediate installation of a power brake, not one seems to be available, or else its efficiency does not appeal as strongly to railway managers in general as it does to the inventor. The latter must not forget that the proof of certainty of action of a power device must be presented against the knowledge of what a hand device will surely do.

In the meantime, the public should be cautious in crossing streets, the motorman watchful, the inventor active, the companies progressive, and the daily press slow to judgment until all concerned have had an opportunity to get used to the new state of affairs. Until then, however, electric cars may have to follow the old saying that "all big things must move slowly," which, being interpreted, may mean a speed between six and twelve miles an hour.

A Non-Mathematical Treatment of the "Rotatory" Converter.

ONE of the grandest manifestations of the transformation of energy and also one of the most potent and convincing arguments of the advocates of the electric current is the latter's great flexibility and ready obedience to simple and fundamental laws. Depending upon the particular use to which it is to be put, and always insuring its greatest efficiency, the electric current can be transformed into and transmitted at any desired pressure and current, having even its direction and other properties modified by simple and commercially practicable means. This has reference to the continuous as well as the alternating current, though it has perhaps more weight with the latter on account of its greater flexibility and wider introduction for the distribution of large amounts of power over great distances, where the factor of economy has to be most carefully considered.

Important and timely then, as a knowledge of the transformation of the alternating current is, and considering the simplicity of Faraday's statement of magneto-electric and electro-magnetic induction and the antiquity of the subject, it would seem as if the fascinating theory of the alternating current transformer

Digitized by Google

in its various types and modifications would be reduced to its simplest and most intelligible form.

How many are there of those engaged in electrical pursuits, and thrown in daily, hourly contact with alternating currents of various kinds and strengths, who understand the mathematics employed by Maxwell, or who have even had the necessary training to grasp the vast amount of mathematical gymnastics contained in the 600 pages of Fleming's "Alternate Current Transformer"? Very few indeed, and while this may be considered by those who delight in the exposition of mathematical logic, as a most unfortunate circumstance, it is nevertheless a fact, and as such it must be met. No one, of course, will deny the saving which can be effected in expressing our thoughts by means of symbols, but not until this shorthand method can be mastered by all, can mathematics be considered the Volapuk of science for the masses. It has been said, and we have evidence of it daily, that the simpler a thing is the more difficult it is to define it, and this may be the cause of the failure of so many modern electrical writers and authors to give a simple, concise and comprehensive statement of the theory of the alternate current transformer in its stationary and rotative forms. Or is it due, perhaps, to the fact that the designers of transforming apparatus are guided so safely and entirely by practice or by experiments conducted on a large scale that theory is no longer consulted? This would appear incredible in the face of the decided and rapid advances made in recent years in alternating current apparatus, yet that we have but few simple treatises on the subject seems to point to the fact that knowledge of the subject is possessed by the select few to whom workers in other directions naturally look for enlightenment.

One of these writers from whom we would expect a contribution of this character, and who has seldom disappointed the profession, is Prof. S. P. Thompson, who on Nov. 10 read a most admirable paper on "Rotatory Converters" before the Institution of Electrical Engineers. The paper, which is a masterpiece of simplicity and completeness, embodies within its thirty-eight pages numerous tables and diagrams and a mint of information without the use of a single formula. In the words of the author, "I have deliberately preferred, for the purposes of the present paper, to avoid formulæ (though they have been used in its preparation), and, instead, to exhibit the arguments numerically by taking specific cases that are readily followed." He describes a "rotatory" converter—we see no reason why the shorter word "rotary" would not do just as well or perhaps better, on account of its brevity—as a machine having something in common both with a dynamo and with a motor, so far as its structure goes, and of which the function performed by its rotation is to transform the electric energy which is imparted to it in one form into an output of electric energy of some other form. He then enumerates and discusses the twelve possible kinds of conversion, some of which are accomplished by means of the ordinary stationary transformers, others by the use of auxiliary choking coils and condensers; while all of them may and some others must be effected by means of rotatory apparatus. The author incidentally mentions the growing favor of the alternating current for railway work and in this paper does not touch upon the development of the stationary transformer. This branch of the topic, however, has been so admirably treated by Mr. Scott in his paper which we are now printing, that the homogeneity of the subject is not disturbed. Prof. Thompson then discusses the two possible methods, namely, the double and single windings on one armature, and considers the latter as being par excellence a rotatory converter. In discussing machines having two armatures mounted on one shaft and placed so that each lies in a similar and equal bi-polar magnetic field, he applies to the combination the name "motor-dynamo." The term "dynamotor," he asserts, is not alone philologically bad, but is a mis-description. When two machines, he continues, of whatever kind, are thus coupled together, it is always the motor which drives the dynamo, not the dynamo which drives the motor.

This does not appear to us to be a sufficient reason for abolishing the shorter and equally well understood term "dynamotor," now finding general favor.

In his consideration of the heating of the armature, Prof. Thompson does not appear to have given due weight to the fact that the heating is largely dependent on the power factor, and that his figures based on a power factor of unity will be materially altered and often dangerously so, when the power factor is less than one, as is generally the case in practice.

The author mentions the converters installed at Niagara, Mechanicville, Brooklyn, and by the Central London Railway as typical examples of modern practice, but speaks most unfavorably of the possibility of running converters in parallel, a fact not borne out, we understand, by American practice.

In conclusion, the author makes reference to the machines called "permutators," which are for the purpose of changing alternating currents of one, two, or three phases, into a continuous current. It is a combination of a species of stationary transformer and a revolving commutator. These machines have been developed of late by Messrs. Hutin and Leblanc, and in the opinion of Prof. Thompson they deserve the further attention of engineers, as there probably are cases where the economic conditions of the problem may point to the permutator as affording a solution preferable to either motor-dynamo or converter.

In sharp contrast to this paper, as far as the mode of treatment of the subject is concerned, is the one on the "Design of Transformers," read on Nov. 23, before the A. I. E. E., by Mr. Fred. W. Carter. This author, an Englishman also, while presenting much valuable data by means of carefully arranged symbols, enters a sphere quite foreign and unintelligible to a large number of his hearers, and leaves them in doubt as to the practical value of the conclusions. In fact, the discussion on the paper brought out the remarkable fact that transformers are mostly designed by precedent, a sort of transformer-design intuition, or by the results of costly and extensive experimenting rather than by following mathematical formulæ. Besides giving results equally certain, the former method effects a saving of time and of "yards" of paper. In an analytical treatment such as is presented by Mr. Carter, a large number of assumptions have to be made at the outset, which may or may not be found to agree with the conditions met with by various manufacturers and designers. If, however, these assumptions are in the main acceptable, and we believe they are, then the paper, if carefully handled, becomes of great and permanent value.

Electric Power on Warships.

SOME time ago we noted with considerable pleasure the good work accomplished on our warships in the rapid handling of the turrets by electric motor. The London "Electrical Review" now quotes a number of letters from the "Army and Navy Register" on the subject, the letters being those of the chief officers, including Commodore (now Rear Admiral) Schley and Capt. Cook. These letters had not before come under our observation, and we are glad to find them so emphatic and direct in their commendation of the great superiority of the "electric system." This generic phrase covers the method, we believe, devised by Mr. H. Ward Leonard, who is certainly to be congratulated not only on the fine record reported so fully, but on the prominence given to the matter here and abroad. Admiral Schley notes that in the ever-memorable battle of July 3, on the Brooklyn, "the turrets controlled by electricity did better and quicker work, and were not so hot as those functioned by steam." For Mr. Leonard, who has reason to regard his method rather as an invention than an evolution, this expert praise must come very acceptably.

Return of the Volunteer Engineers.

IT is a great pleasure to welcome home again Col. Griffin and his regiment of Volunteer Engineers. The conditions of their return from the tropics might well have been more propitious, and even now it is painful to think of that steamer, unheated, lying at her snow-clad wharf unable to land her passengers, while all the time a fine Thanksgiving dinner and hosts of friends were waiting for them on shore. But the regiment is now in happier circumstances, and all these little drawbacks are being forgotten in the general rejoicing of their friends and comrades. It is one of the regrets of the men that they had so little of real war, but killing is not the only civilized warfare, and the regiment has left behind it in Puerto Rico a deep imprint in the shape of better roads and bridges and miscellaneous engineering work. After all, that is better, and we believe that among engineers everywhere the satisfaction will be shared that so many of their fellows volunteered to serve the country when the President issued his call for troops. That electrical engineers were splendidly represented ashore and afloat, will always be one of the happy memories of the war with Spain in 1898.

Digitized by Google

LETTERS TO THE EDITOR

Prof. Dolbear on Mr. Tesla and His Work.

I AM greatly surprised at the mental attitude Mr. Tesla has assumed with reference to the comments that have been made about his late statements as to what he proposes to do. I have carefully read your editorial remarks and fail to find anything there but sympathy, tempered with the recollections of expectations that have come to nothing and a bit of warning much needed, in my opinion.

As for myself, the interviewer came to me with the article purporting to be his verbatim statements of what he could do and some of the devices he was to employ. The chief thing was a navy destroyer that could be operated by a competent person anywhere upon the earth, and that too by a mere act of the will. In this article Mr. Tesla says: "This power can be exerted at any distance by an agency of so delicate, so impalpable a quality, that I feel I am justified in predicting that the time will come when it can be called into action by the mere exercise of the human will." Of this, one may frankly say, that until it is shown that a person can by an act of his will alone, move anything, even the smallest particle of dust in the air, that the idea is contradicted by all human experience. There is no sense in it and will not be until it is done. It will then be time to revise one's judgment, but not before.

Again coherers and Hertz waves are to be employed, but these are not new, for heretofore they have been used to telegraph with in the way he proposes, to a distance exceeding thirty miles. Instead of rapping the coherer he may capsize it, but there is no great merit in that; it confers no new property to the material; it simply is a mechanical equivalent.

But Mr. Tesla wishes to be remembered as the destroyer of war, for the device is to render the art too dangerous. We have all heard that argument. It was paraded when Colt's revolvers and Sharp's rifles were invented fifty years ago, yet the business goes on, and is likely to.

War will not be destroyed by coherers of that sort, even if vessels could be exploded in the assigned way. No patent of that sort would be respected in an international difficulty, and besides every vessel would carry its own protector with it, its syntonizers continuously working through the whole electrical range—an easy thing to do—and the advancing destroyer would be blown up by its own petard.

No. The end to be attained may be desirable, but this means will not reach it, in my judgment. Mankind may depend upon cohesion, but not coherers, if war is to be abolished; and Mr. Tesla must not look for fame in this direction. Evolutionary processes have not been continued for so many thousands of years, to be suddenly superseded by an electric device. The idea is altogether visionary and chimerical. Is it in any degree probable that men will love each other more because they dare not fight each other with gunpowder? There are other means of destruction and they would be used.

Mr. Tesla is a very ingenious man, and some of us wish he wouldn't undertake to do or undo the whole world so often.

A. E. DOLBEAR.

Tufts College, Mass., Nov. 21, 1898.

(The above is the letter referred to in Prof. Dolbear's dispatch, published in our editorial pages last week, and is, therefore, printed. We have received other letters of like import, but, while we are much obliged to their writers, we think the matter may be left as it is.—Eds. E. E.)

MARRIED

McCorkle—Howard.

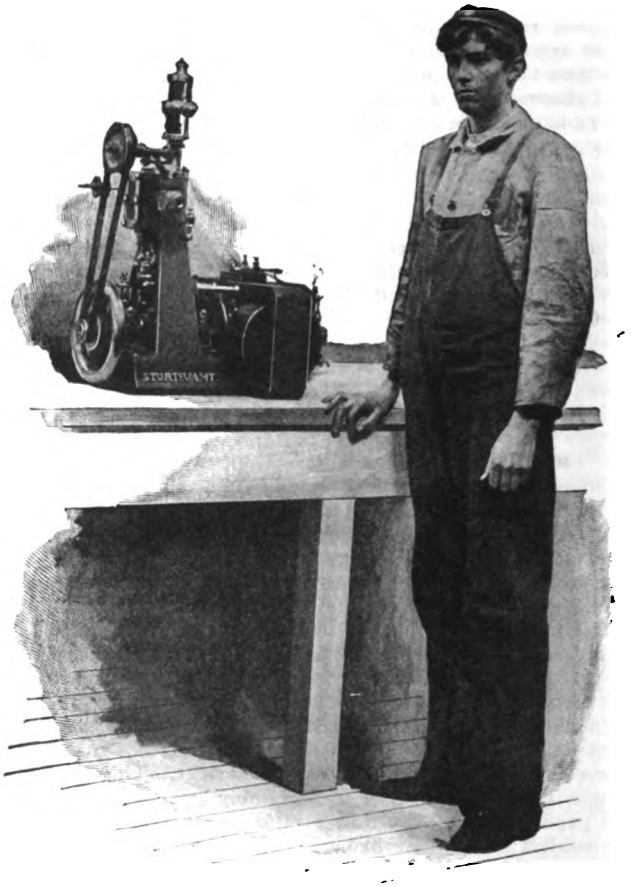
The marriage is announced, at Cleveland, O., of Mr. W. G. McCorkle, editor of the Cortland, O., "Herald," to Miss Georgie Howard, of Orwell. Mr. McCorkle is the manager of the Jefferson-Warren telephone line, and thus became acquainted by wire with his bride, then looking after the Orwell exchange.

ELECTRIC LIGHTING.

A Sturtevant Diminutive Generating Set.

ALTHOUGH the necessity for small, independent electrical generating sets has long existed, practically no successful attempt has been made up to the present day to solve the problem. In the accompanying cut, however, is shown the result of most careful consideration of the problem. This outfit was designed under specific conditions for torpedo boat service, and several of these sets have already been furnished to the U. S. Navy. The engine which has a cylinder 2 in. by 2 in., is compact, extremely stiff and carefully designed as regards adjustment of wearing parts and the character and proportions of the material employed. Steam is admitted through a special form of throttling governor, which is capable of controlling the speed of the engine within very close limits. All moving parts are provided with continuous sight feed oilers.

The engine was designed with a large factor of safety to operate under 200 pounds pressure at 1,000 revolutions and indicate 3 h. p., although intended to be operated at a somewhat less output.



STURTEVANT "MIDGET" GENERATING SET.

The specified limit of weight of the entire set was 500 pounds. The rated capacity of the engine was to be 1.5 kilowatt. In point of fact the finished machine weighed only 400 pounds, thus coming 100 pounds inside the specified limit, bringing the weight efficiency down to 0.266 pounds per watt at rated capacity. The centre of gravity of the set was kept as low as possible in order to economize head room and to insure steadiness in running.

This low centre demanded a special design which was met by the adoption of a 4-pole field with only two field coils on the consequent pole type of magnetic circuit. The field magnet itself is of wrought iron, the pole pieces of the same material being bolted to it. Thorough ventilation and a large radiating surface are secured by making the armature of large diameter.

Digitized by Google

By means of air-ducts placed at the centre and ends of the armature core, the armature is to a certain extent transformed into a centrifugal blower and thorough ventilation is secured. As the back end of the spider is completely closed and thereby rendered oil-proof, the air is necessarily drawn through the commutator.

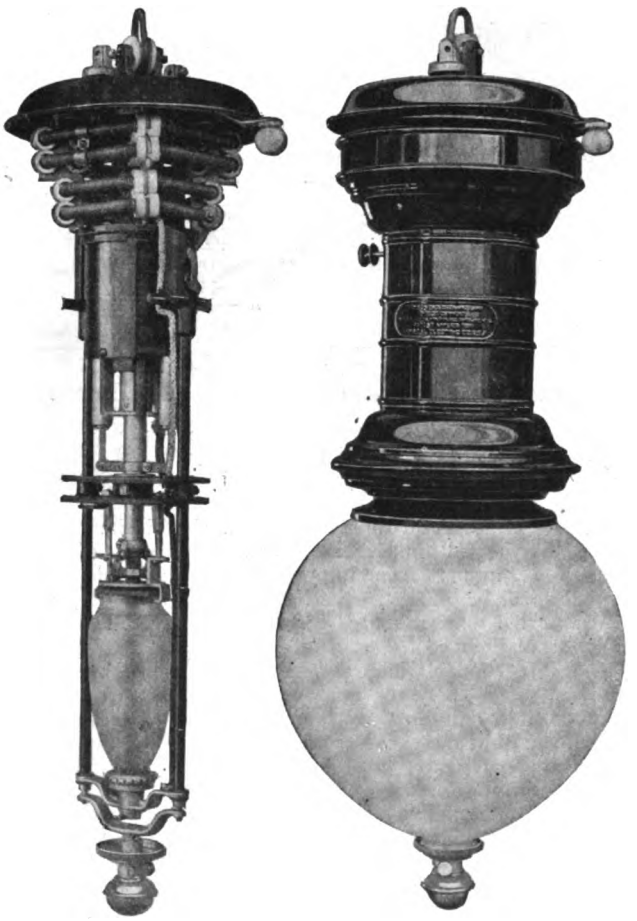
Only two brush holders are used. The armature is of the two-circuit, four-pole, barrel wound type without cross-connections. These brush holders are of the reaction type. The generator is compound wound for a constant e. m. f. (at constant speed) under all changes of load, from no load to 50 per cent. overload without sparking. Twenty-five per cent. overload can be carried with safety.

The fact that a small set like this can be made a perfect success under continuous operation at high speed, insures its introduction and utility under many conditions.

This "Midget" set, so called, was designed aand constructed by the B. F. Sturtevant Company, Boston, Mass.

New G. E. 220 Volt Enclosed Arc Lamp.

A PERFECTED form of carbon feed arc lamp for direct connection across 220 volt mains is being placed on the market by the General Electric Company. It operates with 120 volts at the arc, takes a normal current of 2.5 amperes, and, with one trimming, has a life of from 130 to 150 hours, requiring no attention during that time. These carbons are so proportioned that the upper carbons at the end of any run of 130 or 150 hours may be placed in the lower carbon holder for the next run. The light is of less volume and more violet in color



NEW G. E. 220 VOLT ENCLOSED ARC LAMP.

than the standard 110 volt lamps, but the advantages of a 200 volt lamp, capable of independent operation sometimes compensate for the diminution of light as compared with the General Electric 5 ampere power circuit lamp for use two in series across 220 volt mains. A variable resistance at the top of the mechanism allows the use of the lamp on circuits of from 210 to 250 volts and disconnection from the circuit is effected by a quick break switch applied to each lamp.

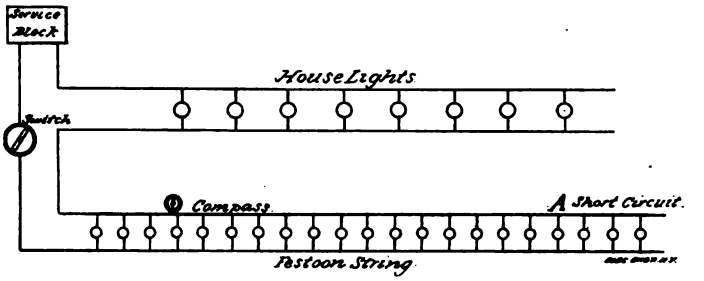
The 220 volt lamp is weatherproof and may be used without a hood. It is especially suitable for lighting vestibules, doorways, window fronts, etc. It may be used with the closed outside globe as shown in the illustration, or with the single globe and flared reflector. The casings are of several designs, the standard weatherproof casing being finished in black enamel.

One Way for Finding a Short Circuit.

BY A. E. DOBBS.

IN constructing the strings of electric lights which were festooned across the streets of Chicago during the Peace Jubilee of Oct. 16-18, the strings consisting of 100 lights each were made up in a long basement cellar.

It would happen occasionally that a socket would be found that short circuited the string. An examination of the sockets did not always reveal the cause of the trouble, and at first it was thought that the socket could be burnt out by throwing current



DETECTING A SHORT CIRCUIT BY MEANS OF A COMPASS.

from the street mains into the string, but after blowing out two or three 150-ampere fuses that plan was abandoned.

Then one of the wiremen got an idea, hunted up a pocket compass and connected up the line, as shown in the figure. A circuit of eight house lights was detached on one side from the service block and connected through the loop made by the short circuit. The compass was then slid along over the string, the needle giving a wide deflection till the short-circuited socket was reached (A), when it stopped and swung back to its normal position. This plan is simple, cheap, convenient and applicable in many cases.

The New Electrical Equipment at McGill University, Montreal.

SINCE Prof. R. B. Owens went to take charge of electrical work at McGill University, the munificence of Mr. W. C. McDonald has again been extended with the object of increasing the facilities of that institution in that branch of engineering study. The new equipment has been purchased, to the extent of $30,000, and it will include the following apparatus: One 100 h. p. high speed single cylinder side crank engine, 200 11 E. chloride cells, one m. p. 75 k. w. 125-volt direct current dynamo, one m. p. 30 k. w. 500-volt direct current dynamo, one m. p. 40 h. p. 125-volt direct current motor, two m. p. 25 h. p. 125-volt direct current motors, two m. p. 20 h. p. 125-volt direct current motors, two m. p. 15 h. p. 125-volt direct current motors, two m. p. 10 h. p. 125-volt direct current motors (the motors are compound wound, with shunt and series turns to vary degree of compounding, and with shunt rheostat to vary speed); one 6-pole 25 k. w. 220 volt revolving field a. c. generator, arranged to deliver single, two or three-phase currents, one two-phase 20 k. w. inductor alternator, one single-phase 15 k. w. inductor alternator, two single-phase induction motors, one 15 k. w. rotary converter, one capacity set, one 10 h. p. induction motor, arranged to be used either as two or three-phase machine, with secondary provided with collector rings, so that the motor can be used as a frequency changer, three 3 k. w. potential regulators, two 5 k. w. two-phase 3-phase transformers, one-phase shifter, one 1 k. w. constant current transformer, five current transformers, one special transformer for a. c. ammeter testing, one 2 h. p. two-phase

Digitized by Google

induction motor, one 200,000 volt testing set, one motor dynamo with double field for battery charging, one motor dynamo with double field for instrument calibration, two small synchronizing motors, one electric welding outfit, one electric plating and typing outfit, four electric speed indicators, one laboratory standard voltmeter, one laboratory standard ammeter, one continuous rheostat, one potentiometer, ten standard cells, thirty voltmeters, ammeters and wattmeters, for general laboratory use, thermometers, one photometer and attachments, one conductivity bridge, two standard megohms, one standard condenser, one hysteresis tester and various fittings and attachments.

The principal laboratories are: Dynamo laboratory, standardizing laboratory, laboratories for advanced investigation. A 75 k. w. direct connected unit will be installed in the service plant for current supply, and a 75 k. w. hour storage battery in three sections in the battery room, adjoining laboratory. There will be a distributing board for 36 circuits. It has been decided to abolish shafting in the dynamo laboratory; every machine will have a separate motor for driving. None of the machines will be fixed permanently in place, but will be mounted on testing blocks, so that they may be readily moved from place to place, for which purpose the laboratory will be equipped with traveling cranes. The low voltage a. c. machines will supply two and three-phase currents. Permanently wired testing tables will be used to facilitate work. The standardizing laboratory contains all instruments necessary for the accurate measurement of electrical and magnetic quantities. The new equipment is expected to be in working order on the reopening of the school after the New Year vacation, although a longer period will be required to thoroughly complete the work.

Massachusetts Institute of Technology.

By a vote of the corporation, the new building just created for the use of the Institute, will be called the Pierce Building, in honor of the late (Hon.) Henry L. Pierce, who was a member of the corporation from 1885 until the time of his death. Himself a leader in a line of business making large demands on science, he has always expressed a keen interest in the Institute, its ideas and work, as shown by visits and suggestions and by his frequent and liberal gifts. His various benefactions amount to $770,000 to Oct. 31, 1898.

There have recently been two pilgrimages to the Institute. Mr. Linwood O. Towne, sub-master of the Haverhill High School, with twenty-three of his students, and Mr. Warner, with twelve pupils from the Springfield Manual Training School, made comprehensive and thorough examinations of the buildings, laboratories and libraries. The mining, chemical and engineering laboratories particularly interested them. In the applied mechanics laboratory they witnessed the testing of specimens of granite to be used in the Clinton Dam. One piece was crushed under the application of a load of 194,000 pounds.

The Michigan College of Mines.

A very complete catalogue enumerating the courses taught by this well known institution has recently been issued and contains much interesting information regarding the courses of instruction and the opportunities offered for practical work. The college, which is situated at Houghton, Mich., is most fortunate in its location, as within a radius of eleven miles are several of the largest, deepest and most successful mines in the world. The range of subjects bearing on the mineral industry taught in this school is extremely wide and is strictly professional and practical.

Electrical engineering is taught by Professors Hood and McNair and includes electrical engineering proper, dynamo electrical machinery, alternating current work and laboratory practice.

NEW YORK CENTRAL R. R. will put an air motor in use at the Metropolitan terminus, to haul trains through the tunnel and lessen the smoke nuisance. The papers say: "Various electrical motors have been tried and have proved unsatisfactory." This is utterly untrue. No electric motors have been tried. There has never been a foot of wire or cable in the tunnel for the purpose.

The "Municipal Plant" of Knowledge.

BY HENRY HOPKINS.

AS a little addendum to my recent articles on the disadvantages of municipal ownership, I think the accompanying cartoon may perhaps interest the readers of The Electrical Engineer. It is probably so plain in its meaning as to need very little explanation. The "municipal plant" has been indeed a tree of knowledge to most of those who have had anything to do with it. The apples are "Dead Sea Fruit;" the trunk is rotten within from depreciation, and the roots that are drawing life out of it are "repairs," "accidents," "insurance," etc., not forgetting the money that would have been derived from taxation.

Water power plants are suggested by the watering pot. There is a whole group of failures in that class, although the plants were pretty freely watered with the taxpayers' money. But the case of Gravesend will be plain to all. The plant cost $120,000, but was never used because the mayor who started it went to prison for some other offences. It was finally sold by the town for $30,000.

The apples on the ground suggest the fallen municipal enterprises. Those still on the tree are tagged with the different prices given by various city officials, experts and others, the higher prices being invariably those nearest the truth, which proves pretty hard to get at.

The American citizen may well stand in alarm, and contemplate the prospect, and wonder where he is "coming out." My little parable may help him arrive at a wise decision when other schemes of spending his money, in the shape of taxes, are brought to his notice for adoption.

Governmental Matters Affecting the Export and Import Electrical Trade.

ASSISTANT Secretary of the Treasury W. B. Howell has written to the Collector of Customs at New York as follows:

"On the exportation of 'incandescent electric lamps,' manufactured by the Edison General Electric Company, of Schenectady, N. Y., in part from imported glass bulbs and tubing, a drawback will be allowed equal in amount to the duty paid on such imported materials used in the manufacture, less the legal deduction of 1 per cent.

"The entry under which the merchandise is to be inspected, and laden must show the marks and numbers of the shipping packages, and the number of lamps in each package, describing the bulbs used as they are described in the import invoice.

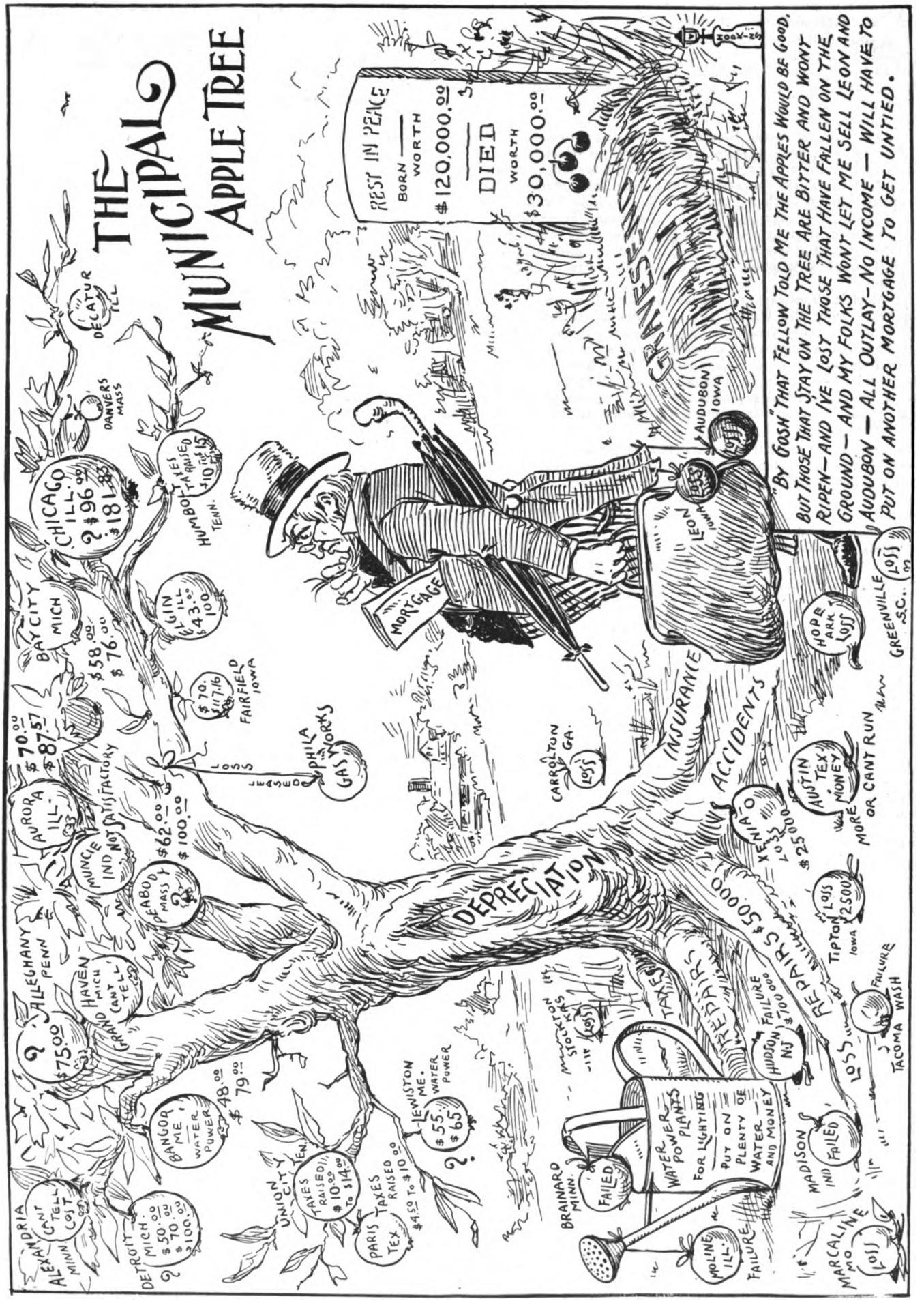
"The drawback entry must show the number of lamps of each kind or description exported, and must further show, in addition to the usual averments, that the said lamps were manufactured and packed for shipment in the manner set forth in the manufacturer's sworn statement, dated May 25, 1898, filed with the Collector of Customs at New York.

"In the liquidation of entries 1,000 glass bulbs and 5 pounds of glass tubing shall be taken as bases of allowance of drawback for each 1,000 lamps exported."

The Secretary further advises that samples may be taken as ordered by the Collector for any official expert examination as he may deem necessary.

Commissioner of Internal Revenue N. B. Scott has replied to a letter received from Mr. W. H. Powell, Collector Thirteenth District, East St. Louis, Ill., as follows: "In reference to the returns to be made by telephone companies, and life insurance companies issuing policies on the weekly payment or industrial

Digitized by Google



(See "The Municipal Plant of Knowledge," by Henry Hopkins, Page 542.)

Digitized by Google

plan, your attention is called to Treasury decision 20059, under which insurance companies receiving first weekly premiums in various collection districts, through local agents, are permitted to include such premiums in the returns rendered in the district in which the company is located.

"I see no objection to the adoption of the same plan in the case of telephone companies, where the conditions imposed are fully complied with."

An official report to the Bureau of American Republics from the Argentine Republic, states that orders for electrical machinery and equipments continue to arrive in fairly large proportions. A New York concern recently received orders to the amount of $20,000 of these supplies. The outlook for work of every sort in the electrical field in Argentine is promising. Every steamer, it is estimated, leaving New York during the past three months, has carried a shipment of machinery and electrical supplies of which the average value was from $7,000 to $10,000.

The electric tramways of Argentine are all supplied with equipments from the United States. During the past two months almost every vessel going to Buenos Ayres has taken $50,000 worth of car material, a large part of which was received by the Belgrano Tramway Company. The Capital Company, whose local offices are in New York City, is an extensive shipper of all sorts of electrical supplies, including car equipments for its own road. Early in this month the company will have a large shipment ready.

The advices state that nearly every tramway company in Buenos Ayres will extend its line to suburban towns; the required equipments will, therefore, be very extensive.

In the matter of the protest of Knauth, Nachod & Kuhne, importers of electrical goods, against the decision of the Collector of Customs at New York, as to the duty to be assessed on certain importations made in 1897, General Appraiser Somerville has rendered the following opinion:

"The merchandise consists of incandescent lamps used for electric lighting, and composed of blown glass, metal, porcelain, carbon filaments and cement. Blown glass is the compound material of chief value, but the other materials are unquestionably substantial and essential features of the articles, and necessary not only in the construction of these lamps, but to adapt them for the uses for which they are intended. The glass portion of the lamp is not cut, engraved, painted, colored, stained, silvered, gilded, etched, frosted, printed,' or otherwise ornamented, decorated or ground.

"The goods were assessed for duty at 60 per cent. ad valorem under paragraph 100, tariff act of 1897, which reads as follows:

"'100. Glass bottles, decanters or other vessels or articles, or glass, cut, engraved, painted, colored, stained, silvered, gilded, etched, frosted, printed in any manner, or otherwise ornamented, decorated or ground (except such grinding as is necessary for fitting stoppers), and any articles of which such glass is the component material of chief value, and porcelain, opal, or other blown glassware; all the foregoing, filled or unfilled, and whether their contents be dutiable or free, 60 per cent. ad valorem.'

"The importers make the following claims: 'That the articles are dutiable at 45 per cent. ad valorem under paragraph 112 of said act as manufactures of which glass is the component material of chief value, not specially provided for in said act; or, if not so dutiable, that they are subject to classification under paragraph 193 of said act as 'articles or wares not especially provided for, in said act, composed in part of metal.'

"The protest must be sustained under the rule laid down on which certain thermometers made of glass, metal and other materials were held to be dutiable under paragraph 102, tariff act of 1894, as manufactures of glass not specially provided for, and not under paragraphs 89 or 90, as articles of glass cut, painted, engraved, etc. It is true that thermometers of that description, composed in part of glass which is etched, engraved or otherwise ornamented in the manner described in said paragraph 100, would be subject to classification under said paragraph, as the law now stands, where 'such glass is the component material of chief value.' The incandescent lamps under consideration are manifestly not merely blown glassware within the meaning of the phrase, but are manufactures of blown glassware and the other various component materials above specified.

"The protest is overruled so far as its claims under said paragraph 193, but is sustained as to the claim under said paragraph 112, and the Collector's decision is reversed, with instructions to reliquidate the entry accordingly."

On the Electrical Properties of the Vapors from the Carbon Arc.[1]

BY ERNEST MERRITT AND O. M. STEWART.

THE air, as well as other gases, is usually a non-conductor except when at a very high temperature. The gases from a flame, however, are to some extent conductors of electricity. They possess the power, for example, of discharging an electrified body with which they come in contact. Other gases acquire this discharging power when acted on by X-rays and retain it for a fraction of a second. The authors find that the vapors from an arc light behave in almost exactly the same way as do gases which have been acted on by X-rays, except that they retain their discharging power longer. If the vapors are drawn from the arc through glass or metal tubes, and caused to pass between a charged body and one that is grounded, the former will gradually lose its charge. The discharge current is, however, not proportional to the potential difference, but increases less rapidly than the latter and approaches a limiting value. If the vapor of water is introduced into the arc the rate of discharge is greatly increased. All the phenomena observed may be explained upon the assumption that the air is "ionized" by passing through the arc; that is, the molecules of air are to some extent torn apart so as to form positive and negative ions as in electrolysis. These ions rapidly recombine, and their number being limited the maximum current that can be carried by the vapor is relatively small.

The experiments probably have an important bearing upon the theory of conduction in the electric arc.

Exports of Electrical Material from New York.

THE following exports of electrical material are from the port of New York for the week ending Nov. 7: Antwerp—Four cases electrical material, $2,821; ten packages electrical machinery, $600. Africa—Three cases electrical material, $457. Argentine Republic—One hundred and fourteen cases electrical material, $5,957; thirty cases electrical machinery, $2,781; one case eletrcs, $2. Brazil—Two cases electrical material, $110. British possessions in Africa—Four cases electrical material, $146. Bremen—Six cases electrical material, $500. British Guiana—Eight packages electrical material, $259. British West Indies—One hundred and eighty-six packages electrical material, $16,867. Cork—Four cases electrical machinery, $166. Cuba—Forty-four cases electrical material, $1,159. Central America—Sixteen cases electrical material, $285. Chili—Fifteen cases electrical material, $189. Dutch West Indies—Three cases electrical material, $37. Dresden—Two packages electrical material, $27. Ecuador—Six cases electrical material, $125. Glasgow—Eight packages electrical material, $856; four cases electrical machinery, $123. Hong Kong—Eleven cases electrical material, $714. Japan—Two electric motors, $790. London—One hundred and eighty-four cases electrical material, $7,200; twenty-one cases electrical machinery, $1,560; one case electros, $117. Liverpool—Twelve packages electrical machinery, $220; twelve cases electrical material, $291. Mexico—Seventeen cases electrical material, $792; five cases electrical material, $50. Newfoundland—Six packages electrical material, $58. Nova Scotia—One package electrical material, $24. Newcastle—Sixteen packages electrical material, $25. Odessa—Twenty-nine cases electrical material, $916. Peru—Twenty-one cases electrical material, $387; three cases electrical machinery, $490. Porto Rico—Sixty packages electrical material, $1,304. Rotterdam—One case electrical machinery, $300. Siam—Twenty-seven packages electrical material, $700. Santo Domingo—Eight cases electrical material, $75. Southampton—Eight cases electrical material, $628. Uruguay—One case electrical machinery, $739; eight cases electrical material, $203. U. S. Colombia—Forty-four packages electrical material, $1,154; three cases electrical machinery, $704. Venezuela—Two packages electrical material, $27; seven cases electrical material, $80.

BUENOS AYRES. The steamer Kaffir Prince took $14,000 of electrical machinery for the Argentine, and over $12,000 of car material.

[1] Read before the A. A. A. S. Abstract.

Digitized by Google

SOCIETY & CLUB NOTES

American Institute of Electrical Engineers.

THE one hundred and twenty-ninth meeting of the Institute was held at 12 West Thirty-first street, Wednesday evening, Nov. 23, President Kennelly in the chair. The paper of the evening on "The Design of Transformers," by F. W. Carter, of London, England, was read by Prof. W. S. Franklin, of Lehigh University, in the absence of the author. It was discussed by Messrs. Franklin, W. B. Jackson, Wolcott, Henshaw, Torchio, Pupin and others. At meeting of the Executive Committee in the afternoon the following associate members were elected: Cleveland Abbe, Professor of Meteorology, The Weather Bureau, Washington, D. C.; residence 2017 I street, N. W., Washington, D. C. John Cassidy, superintendent Mutual Telephone Co., Honolulu, Hawaiian Islands, U. S. A. James Francis Cosgrove, head of locomotive engineering department International Correspondence Schools, 631 Madison avenue, Scranton, Pa. Donald Hume Fry, assistant to Robt. McF. Doble, 202 Sansome street, San Francisco; residence, Blue Lakes City, Cal. James Hamilton, patent attorney and expert in patent causes, 54 State street, Boston, Mass. Bernhard Hoffman, New York Telephone Co., 15 Dey street, New York City. Harry D. James, expert draughtsman, Otis Bros. & Co.; residence, 100 Buena Vista avenue, Yonkers, N. Y. S. L. G. Knox, first assistant engineer, Crocker-Wheeler Electric Co., Ampere; residence, Montclair, N. J. Howard Wallace Leitch, switchboard regulator, The Edison Electric Illuminating Co.; residence, 373 Madison street, Brooklyn, N. Y. R. W. Lohmann, electrical engineer, 1387 Madison street, Oakland, Cal. C. Stowe Reno, electrical engineer, Triumph Electric Co., 620 Baymillen street, Cincinnati, Ohio. R. H. Sperling, assistant engineer, British Columbia Electric Railway Co., Ltd., Victoria, B. C. James Wilkinson, station manager, chief engineer, Consolidated Electric Light Co., 812 South Nineteenth street, Birmingham, Ala. A. Wilford Zahn, electrical engineer and superintendent, Manhattan Light, Heat & Power Co., Manhattan Building, St. Paul, Minn.

The following associate members were transferred to full membership: Franklin Robert Anson, secretary and manager, Salem Light & Traction Co., Salem, Ore. Sidney Hand Browne, consulting electrical engineer, Baltimore, Md. A. E. Brooke-Ridley, agent and electrical engineer, Siemens & Halske Electric Co., San Francisco,

The Committee on Co-operative Research having completed the first stage of its work, has sent various collegiate electrical engineering departments an explanatory circular submitting 37 subjects for investigation.

Connecticut Street Railroad Association.

The fourth annual meeting of the Connecticut Street Railroad Association was held in the offices of the Fair Haven & Westville Road, New Haven, on Nov. 18. Only routine business was done. The officers for next year were elected as follows: President, Henry S. Parmelee, Fair Haven & Westville Railroad Company; vice-president, Congressman E. J. Hill, Norwalk Street Railroad Company; treasurer, E. S. Goodrich, Hartford Street Railway Company; secretary, B. W. Porter, Derby Street Railroad Company. The executive board for the year was elected as follows: President Parmelee, Vice-President E. J. Hill, A. M. Young, Waterbury Traction Company, C. S. Treadway, Bristol & Plainville Tramway Company, A. W. Mather, Central & Electric Railway Company, New Britain.

The Electrical Exhibition Co.

At the annual meeting of stockholders of the Electrical Exhibition Co., held Nov. 21, 1898, it was unanimously decided to hold another electrical exhibition in this city in 1899. The following officers and directors were elected: C. O. Baker, Jr., president; F. W. Roebling, vice-president; Geo. F. Porter, secretary and treasurer; H. H. Harrison, L. F. Requa, J. W. Godfrey, C. A. Lieb; Marcus Nathan, general manager.

New York Electrical Society.

The Society held a meeting on Nov. 17 at the College of the City of New York, when the paper by Mr. E. H. Johnson on "Surface Contact Railways" was read before about 100 members. There was a brief discussion. The following new members were elected: Prof. J. Burkitt Webb, Stevens Institute, Hoboken, N. J.; Hubert Greaves Webb, Glen Ridge, N. J.; Henry V. Parsell, 31 E. 21st street, N. Y. City; Joseph White Stickney, 76 Hicks street, Brooklyn, N. Y.; Augustus Treadwell, Jr., Electric Storage Battery Co., 20 Broad street, N. Y. City; Morton Arendt, 42 W. 126th street, N. Y. City; W. G. Burns, 423 E. 117th street, N. Y. City; Theo. H. Joseph, 32 E. 74th street, N. Y. City; Bernhardt Hoffman, N. Y. Telephone Co., 15 Dey street, N. Y. City; W. I. Thompson, 136 Sumner avenue, Newark, N J.; Frank R. Wainwright, Chesley Electric Co., 20 Cortland street, N. Y. City; Thomas J. Buckley, Tenafly, N. J; St. John P. Chilton, 11 W. 39th street, N. Y. City; William Newton, Ryerson, Montclair, N. J.; Thomas J. Fay, Electrical Engineer Inst. of Correspondence Instr., 120 Liberty street, N. Y. City; J. E. Woodbridge, Editor "Electrical World," 9 Murray street, N. Y. City; Chas. E. Dustin, Excelsior Electric Co., Brooklyn, N. Y.; Henry B. Cutter, 1112 Sansom street, Philadelphia, Pa.; Alexander McGill, 1190 Madison avenue, N. Y. City; Charles T. Child, Electrical Editor "Engineering Magazine," 120 Liberty street, N. Y. City; Lieutenant W. D. Weaver, "American Electrician," 26 Cortlandt street, N. Y. City; Dr. Louis Duncan, Empire Building, N. Y. City; A. E. Clifford, "American Electrician," 26 Cortlandt street, N. Y. City; A. Stamm, Chesley Electric Co., 601 Newark street, Hoboken, N. J.; V. C. Gilpin, Cutter Elec. & Mfg. Co., 120 Liberty street, N. Y. City.

PERSONAL

A Gold Medal From Omaha.

IT is a matter of gratification to electrical engineers that one of the four gold medals bestowed by the Omaha Exposition should come their way, being awarded to Mr. Luther Stieringer, one going to the landscape architect, Mr. Ulrich, and two to the architects-in-chief, Messrs. Walker and Kimball. Mr. Stieringer, who was the consulting electrical engineer of the Exposition and designer of illumination, has also been awarded a bronze medal with diploma of highest award for "artistic effect of the electric illumination of the grand court and the Nautilus Fountain." As these come after a diploma and a silver medal to Mr. Stieringer at the Atlanta Exposition—not to mention the awards in the same line at the World's Fair—it is evident that proper lighting and spectacular illumination take a high place in the thoughts of latter-day exposition managers, and that the value of electricity as a medium through all the range of work has become fully recognized. It may also be noted incidentally that one of the features of this new work has been the wonderful stimulus given to night photography, a series of pictures having thus been secured that it would be hard to surpass, or even to equal.

The Brooklyn "Eagle," in speaking of this matter at great length, says that Omaha profited by Chicago, Atlanta and Nashville, and probably beat them all. One of the Western papers, in summing up the chief reasons for this year's Thanksgiving, put the Grand Court at Omaha and its beautiful lighting "way up" in the list.

Prof. Roentgen to go to Leipsic.

The "New Yorker Staats-Zeitung," in a dispatch from Berlin, announces that Professor W. C. Roentgen, the discoverer of the rays bearing his name, has been tendered the chair of philosophy in the University of Leipsic, with exceedingly flattering inducements. It is also stated that the Professor will accept the call. In connection with this report, it may be of interest to state, that not long ago, in recognition of his valuable labors, Prince Ludwig of Bavaria created Prof. Roentgen a baron. Kaiser Wilhelm has decorated the great scientist with the Order of the Royal Crown.

MR. HERMANN HERBERTS, whose method for preventing collisions at sea was described and illustrated by us last

Digitized by Google

August, left for Berlin, Germany, on Nov. 26, to accept the position of assistant electrical engineer with the Bergman Elektromotoren und Dynamo Werke. Mr. Herberts appears to be well qualified to discharge the duties of this position as he has had a varied experience in the electrical field. After serving in the wire department of the Edison Elec. Illum. Co., Mr. Herberts entered the student course of the General Electric Company, and gradually worked through all the departments, finally becoming assistant foreman of the testing department. After remaining with that company for six years, he spent one year in the repair works of A. K. Warren & Co., and later two years in the testing department of Mr. D. McFarlan Moore. Of late, Mr. Herberts has done considerable experimental work. He leaves this country accompanied by the best wishes of his many friends in the profession.

MR. A. M. YOUNG, president of the National Electric Light Association, has moved his headquarters from Waterbury, Conn., to 100 Broadway, New York, in order to be near the large electrical interests he has acquired in these parts, including the general management of the consolidated electric lighting companies of Brooklyn, N. Y.

MR. H. H. VREELAND, president of the Metropolitan Street R. R. Co., has been elected president of the Railroad Club of New York, a body which has hitherto always had in that capacity an officer of a steam railroad. But Mr. Vreeland was once a steam railroad man.

LEGAL NOTES

Alternating Current Meter Patents—The Westinghouse and Thomson-Houston Cos. vs. the Citizens' Electric Co. and Diamond Electric Co.

In three suits brought by the Westinghouse and Thomson-Houston Companies vs. the Citizens' Electric Co., of Brooklyn, in the U. S. Circuit Court for the Eastern District of New York, decrees have been entered against the Citizens' Electric Co., enjoining them from the use of alternating current meters manufactured by the Diamond Electric Co. The patents in suit are numbered 448,894, issued to Elihu Thomson; 511,559 and 511,560, issued to Nikola Tesla, and 386,003 and 386,004, issued to O. B. Shallenberger. The two Tesla patents mentioned above are two of the broad patents on split phase motors and apply to certain forms of fan motors. The two Shallenberger patents relate to that inventor's meter.

THE STOCK MARKET

A Thanksgiving Situation.

The strength of the American political, financial, industrial and agricultural situation has become the subject of general consideration at this Thanksgiving period, and that it is generally appreciated abroad is shown by many proofs. At home the stock market has been active and strong, and practically all the trade developments are very favorable.

During the past week, 10,059 shares of Western Union were sold at from 93⅛ to 93⅞, closing at the lower price. Of General Electric, 2,306 shares were sold, closing at 82¼. Metropolitan Street Railway on sales of 21,683 shares was strong and closed at 176¾. New York Edison Illuminating has been remarkably strong and closed the week at the high price of 150¼, having gained $25 per share within the month. In Boston, Am. Bell Telephone closed at 282 and West End Railroad at 88½, both on small sales.

In metals, copper, New York, was quoted at 12.75; heavy steel rail was weaker at $17.50; lead was 3.65 cents.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued November 15, 1898.

Alarms and Signals:—

SIGNALING APPARATUS. Morris Martin, Malden, Mass., assignor, by mesne assignments, to F. Benedict Herzog, New York, N. Y., 614,404. Filed Sept. 28, 1895. Means by which a signal, the nature of which is determined at one station, may be reproduced or made known at another station at any subsequent time, the transmission or act of reproducing the signal being capable of being effected from any point in the circuit connecting the two stations.

Batteries, Secondary:—

METHOD OF CHARGING SECONDARY BATTERIES. Cyprien O. Mailloux, New York, N. Y., 614,228. Filed April 24, 1891. Consists in producing progressive changes of supplemental electromotive force acting with an electromotive force in the circuit of the battery, and in accordance and progressively graduated to the progress of the charge and increases of counter electromotive force in the battery.

ELECTRIC ACCUMULATOR. Federico Pescetto, Turin, Italy, 614,339. Filed Dec. 24, 1897. An electrode for secondary batteries having an active mass containing ulmate of ulmin.

Conductors, Conduits and Insulators:

INSULATED SUPPORTER FOR ELECTRIC OR OTHER WIRES. Charles K. King, and George A. Mead, Mansfield, Ohio; said Mead assignor to the Ohio Brass Company, Ohio, 614,270. A support for trolley wires comprising a clamp, a hanger-body, including an insulator-washer, a threaded studbolt mounted therein and adapted to be screwed into the clamp, and a lock-washer interposed between the insulator-washer and clamp.

Dynamos and Motors:—

ALTERNATING CURRENT MOTOR AND MODE OF OPERATING SAME. Charles S. Bradley, of Avon, N. Y., assignor to the General Electric Company, New York, 614,076. Filed June 22, 1896. Overhead trolley system utilizing alternating current.

ARRANGEMENT FOR EXCITING MAGNETS OF DYNAMO MACHINES. Max Dédi, Vienna, Austria-Hungary, 614,373. Filed July 27, 1898. Employs a field magnet arranged around the armature in such a way that the iron of the magnet is equally distributed around and equidistant from the armature, there being two groups of excitation-coils having an equal number of poles and the polar divisions being displaced mutually through half a pole distance.

Lamps and Appurtenances:—

PORTABLE ELECTRIC LAMP. Owen T. Bugg, Jr., New York, N. Y., 614,318. Filed March 15, 1898. Comprises a single tubular conducting-casing and an insulating lining therefor, combined with one or more battery cells, electrically connected with the casing at its lower end and one terminal of an electric lamp carried also by the casing, together with an electrical conductor connecting the upper pole of the battery with the remaining terminal of the lamp.

Measurement:

ELECTRIC METER. Ludwig Gutmann, Peoria, Ill., 614,225. Filed Dec. 4, 1897. Comprises a main coil and a shunt coil, establishing fields in non-intersecting planes, with an endless conductor provided with perforations, a spindle for the endless conductor, a counting train adapted to engage with the spindle, and a retarding magnet reacting on the rotary conductor.

Miscellaneous:—

APPARATUS FOR HEATING AND AGITATING AIR. Edwin F. Porter, Boston, Mass., assignor to the Bay State Electric Heat and Light Company, Jersey City, New Jersey, 614,275. Filed Dec. 27, 1897. Consists of a series of plates and means for heating plates, and mechanism for operating one or more of the plates relatively to each other to agitate the surrounding air.

THERMOSTAT. Edward Cary, New York, N. Y., assignor to Alice Gilbert and Charity Cary, New York, N. Y., 614,288. Filed Sept. 16, 1897. Details of construction.

APPARATUS FOR WASHING ALKALI AMALGAM. Henrik Christian Fredrik Stormer, Christiania, Norway, 614,353. Filed Feb. 7, 1898. Comprises a suitable vessel adapted to receive the amalgam and a solvent of its cation, a drum composed of two heads, concentric rows of bars extending from head to head and a metallic open-mesh fabric threaded zigzag through the bars.

Railways and Appliances:—

INTERMITTENT ELECTRIC SURFACE CONDUCTOR. Franz Burger, Fort Wayne, assignor of three-fourths to Henry Williams, Fort Wayne, 614,082. Filed July 23, 1897. Means whereby when the trolley wheel passes through the slot, the contact pieces are pressed into engagement with the feeding conductor and rise therefrom by the resiliency of the covering.

ELECTRIC SWITCH MECHANISM FOR ELECTRIC RAILWAYS. John McLeod Murphy, Torrington, Conn., assignor of two-thirds to David F. Halsted, New York, N. Y., and William M. Keepers, Newark, N. J., 614,124. Filed Sept. 3, 1897. Designed for sectional third rail system.

ELECTRIC CAR TRUCK. Edward Cliff, Newark, N. J., 614,161. Filed Aug. 24, 1898. The side frames are combined with the springs and extending from the ends thereof and supporting the transverse bar for the electric apparatus.

TROLLEY. Francis A. Le Court, Rockport, Mass., 614,208. Filed June 17, 1898. Comprises a trolley wheel concaved at its ends, a trolley pole, a bracket mounted on pole and having provisions for journaling wheel, the bracket being provided with side flanges fitting within the concaved ends of the wheel, and engaging the rims thereof inside of the outer edges of the latter.

TROLLEY CONTROLLER. John Dolan, Dayton, Ohio, 614,321. Filed April 23, 1898. Means whereby when the trolley leaves the conductor wire the trolley pole will be automatically drawn down below the level of the wire and out of position to contact with obstructions.

ELECTRIC SWITCH-OPERATING MECHANISM FOR RAILWAYS. Louis E. Walkins, Springfield, Mass., assignor of one-half

Digitized by Google

to George M. Jewett, Glenville, Md., 614,412. Filed Sept. 7, 1898. Details of construction.

Regulation:—

STARTING RESISTANCE FOR ALTERNATING CURRENT MOTORS. Ernst Ludwig Karl Friedrich Kahlenberg, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, of Chicago, Ill., 614,394. Filed Dec. 30, 1897. Consists in altering asymmetrically the several groups of resistance connected in the individual circuits of the dynamo electric machine, whereby its operative condition is governed.

Telephones:—

TELEPHONE EXCHANGE SYSTEM. William E. M. Jackson, Chicago, Ill., 614,207. Filed January 14, 1896. Transfer system; details of construction.

Painting to Prevent Corrosion, with Specifications.

This is the name of a book by A. H. Sabin, M. S., published by Edward Smith & Company, 45 Broadway, New York, varnish makers and color grinders. It gives a complete history of paints and varnishes as used in high building and bridge construction, and contains chapters on acid, benzine, oil, bridge protection, cleaning, painting in cold weather, crevices, decorative paint, exposure to weather, metallic iron not found in nature, pickling, painter's torch, repainting old work, rusting, sand-blast, scales, smoke-stacks, steel frame buildings, turpentine, varnishes, water tanks, wire brushes, etc. The book has been gotten up at much expense with the very best facilities, much of the matter having been submitted in manuscript to the criticism of numerous eminent engineers in all parts of the country. The book contains eighty pages, a large number of which are blank memorandum pages; is handsomely bound in leather, and is well indexed. It is not to be regarded as advertising matter, but is a scientific treatise on the subject, and will be sent to those who are interested in the subject until the edition is exhausted.

Western Electrical Supply Co.

The Western Electrical Supply Company, of St. Louis, Mo., are just issuing their new and very complete House Goods Catalogue, No. 18A, which will be ready for distribution in about ten days. This company have, they think, many flattering inducements to offer in the house goods line, and it is their constant aim to keep apace with the times. It is to be hoped that any one interested in electrical house goods will communicate with the Western Electrical Supply Co., who, upon receipt of address, will take pleasure in sending a copy of the book as soon as it is issued.

Lombard Water-Wheel Co.

A very handsome catalogue just issued by the above company, of 61 Hampshire street, Boston, Mass., sets forth the well known advantages of the Lombard water wheel governors. It gives in a convenient form a general description of the water-wheel governors which that company manufacture, together with a few speed diagrams showing the degree of regulation which they have produced; also a few letters from companies using these governors, setting forth their experience with, and opinion of them. The catalogue is handsomely and appropriately illustrated, showing a number of water-wheel installations in this country and abroad, and filled with interesting, descriptive matter, setting forth the advantages of this type of governor, and giving valuable data on water power installations. The catalogue will be sent to any one on application.

Whiting Foundry Equipment Co.

This company, located at Harvey, Ill., have deemed it advisable to issue a second edition of their general catalogue, in order to meet the increasing demand for descriptions of various articles manufactured by them needed in the equipment of well appointed foundries and shops. While the company consider the furnishing of complete equipments for foundries as a special feature of their business, they do not limit themselves to this field alone, but manufacture numerous appliances of utility in almost any line of industry. A reference to the index of this new catalogue indicates the general character of their manufactures. They have additional catalogues of cranes, cupolas, air hoists and "Avery" molding machines, which give full details concerning the construction of this apparatus. The company invite correspondence and solicit patronage of all interested in or using machinery which they manufacture.

Frink's Patent Reflectors.

Catalogue No. 32 very much enlarged, beautified and more amply illustrated than its predecessors, has recently been issued by I. P. Frink, 551 Pearl street, New York. It shows a great variety of electrical and combination fixtures for lighting churches, halls, banks, stores, store windows, schools, hospitals, office and public buildings, factories, etc. On each page a different style of reflector is shown, which is evidence that the subject has been so thoroughly worked out and studied by Mr. Frink that it seems as if there is nothing in that line which could possibly be devised that has not been previously thought of by this concern. The catalogue contains 63 pages, is handsomely printed and will be sent to anyone on application.

The Turner Oil Filter and Waste Cleaning Machine.

This is the title of a very handsome brochure issued by M. A. Turner, 911 Monadnock Block, Chicago, Ill. It sets forth the advantages of the Turner oil filter, which is claimed to save 75 per cent. of lubricating oil which would otherwise be thrown away. The catalogue, which is amply illustrated, gives sectional views of the filter, which explains its action and details of construction. It also gives directions for setting it up and operating it. A number of users of these filters are cited and the various types shown. A cut and full description of the waste cleaner are also given. This is a very helpful and efficient machine. A boy can gather the soiled waste from the various engines and machines and, instead of putting it into the furnace and burning it, will pass it through the machine and in one process collect the oil at one end and the washed waste at the other and use it over and over again. The catalogue will be sent to anyone on application to the company.

The Westinghouse Electric Turn-Table "Donkey."

In our issue of Aug. 25, 1898, we gave a full description, with a number of illustrations, of the "Westinghouse Electric Turn-Table," which has been termed the "donkey" by the company. It consists, as there stated, of their "series-reversible" 10 h. p. motor, mounted within a heavy cast-iron frame, having a traction wheel which rests upon the rail of the turn-table pit. Power is transmitted to this wheel through double reduction gears. Extensive experiments have been carried on by the Westinghouse company and a number of railroad companies, the results of which have been embodied in a neat catalogue issued by the Westinghouse Company, entitled "The Modern Roundhouse Turn-Table." The methods developed by this company should appeal very strongly to railroad managers, inasmuch as it requires no change in the turn-table proper, other than attaching the drawbar lug to the turn-table girder.

Mechanical Draught for Steam Boilers.

A VERY interesting and valuable lecture on the above timely topic was delivered by Walter B. Snow, of the engineering staff of the B. F. Sturtevant Company, at Sibley College, Cornell University. The lecture, which appears in full in the November issue of "Cassier's Magazine," abounds with interesting figures, showing the advantages of induced draught and the inefficiency of natural draught with its attending waste of fuel. The author touches but lightly, still sufficiently, on the theoretical side of the question, reaching the conclusion that the fan is more economical than the chimney. This economy, he states, means that if a fan is employed, the surplus heat can be utilized and the gases reduced to a minimum temperature before they escape, without impairing the draught. Undoubtedly, he says elsewhere, the source of the greatest loss in boiler and fuel efficiency lies in the usual high temperature of the escaping gases. In seventeen independent boiler tests, Donkin and Kennedy found the heat lost up the stack, when no economizer was used, to range between 9.4 and 31.8 per cent. of the total heat of combustion.

Digitized by Google

A reprint of the article in pamphlet form, which abounds in valuable data and numerous illustrations, will, we understand, be sent to anyone on application to the B. F. Sturtevant Co., Jamaica Plain Station, Boston, Mass.

Improved Brush Arc Lamps.

"Improved Brush Arc Lamps" is the title of an artistic brochure just issued by the General Electric Company dealing with the modifications introduced in the latest types of single and double Brush arc lamps as experience with the operation of past types has dictated. Each detail of improvement is explained clearly and concisely, and in conjunction with first class half-tone illustrations, so that even persons unfamiliar with the Brush lamp mechanism will find no difficulty in grasping the import of the various changes and improvements. The leading features are summarized, each under its own heading, and the brochure concludes with a full catalogue of the parts not only of the improved lamp, but also of lamps 30 and 31. The pamphlet is issued from the General Electric Company's own printing office, and in general artistic appearance, letter press and illustrations compares well with the work of our best catalogue makers. It will be sent to those interested on application to any of the company's sales offices.

Julius Andrae & Sons' Company.

A very complete and handsomely illustrated catalogue has recently been issued by the well known firm of Julius Andrae & Sons' Company, Milwaukee, Wis., manufacturers of the Andrae telephones and electrical supplies. These telephones need no introduction to the trade, as they have been widely installed in independent telephone exchages throughout this country. Besides having taken special pains with their telephone apparatus, the company have so arranged their circuits that they are a means of protection against induction and prevent receiver coils from burn-outs. At each switch point where contacts are made positive contact and action are insured. Their bridging and series telephones are adapted to meet the exacting requirements of toll, private and exchange service and are equipped with the Ericsson coal grain carbon transmitter. They have also incorporated the advantages of the two-pole receiver, namely, its small weight and size. The material used in their magneto bell is said to be of the finest quality obtainable. The Andrae long lever gravity switch insures positive action and reduces switch troubles to a minimum. There are further illustrated their long distance, swinging arm desk set, just the thing for a busy man to expedite business. They also illustrate inter-communicating or warehouse systems of telephones, switchboards, lightning arresters, magneto and extension bells, the Ericsson coal-grain micro-telephone, switch transformer and various kinds of batteries, telephone line supplies, etc. The catalogue will be sent to anyone on application.

George M. Mayer Model and Machine Works.

The above firm, 79 Fifth avenue, Chicago, Ill., have recently sent to the trade a small leaflet illustrating a great variety of drops, spring jacks, plugs, which have not been included in their general catalogue recently issued. The company are reported as doing a large business in telephone and switchboard supplies. Additional information and prices will be gladly furnished by the company.

Goulds Efficient Power Pumps.

This is the title of a very complete, handsome and interesting catalogue on power pumps for every service recently issued by the Goulds Manufacturing Company, Seneca Falls, New York. The catalogue, consisting of 92 pages, contains the description of a great variety of pumps too numerous to mention here. Some of those shown are the Goulds triplex power pump, triplex high pressure boiler feed pump, horizontal tank pump, triplex pump arranged for gas and gasoline engines, electric house pumps, triplex electric pumps, horizontal vacuum pumps, stove pumps, ammonia and brine pumps, Goulds differential working head and geared driving shaft, Goulds horizontal centrifugal pumps, as well as a complete description of the automatic start and stop electrical controller, rheostats, clutch and regulators, and many tables, with useful information and a table of capacity of pumps.

W. R. Rodrigues' Baby Motor.

W. R. Rodrigues, of 10-14 Whipple street, Brooklyn, N. Y., calls attention by a small circular to his "Premier" products, mainly his well known baby motor, which has met with such popular success. This is due in a great measure to the high grade of material and workmanship furnished. No wire nails are used for shafts, nor cardboard for fibre, nor rivets for screws; nor shop worn wire. Everything is strictly in sight and on merit alone it stands. The motor when finished weighs ten ounces, is three inches high, and will run on one cell of battery. He also designs and makes special motors to order for operating phonographs, gramophones, etc., or any other purposes. Prices and their details will be gladly furnished on application.

Hoppes Steam Separators and Oil Eliminators.

A catalogue illustrating steam separators and oil eliminators, manufactured by the Hoppes Manufacturing Company, Springfield, Ohio, bears the date of October, 1898. It illustrates the company's new type, which has been designed to secure the highest possible efficiency in a steam separator with the least possible obstruction to the flow of the steam. The principal feature of the separator is the interception of the entrainment by gutters which are kept partially filled with water. The catalogue further illustrates the Hoppes separators with steel shells which are built on the same general plan as the cast iron ones and range in size from eight to twenty inches. They contain no baffle plates or other loose parts that are likely to get out of order, but, on the contrary the working parts of the separator are ten times the area of the pipe. There are further shown the Hoppes live steam feed-water purifier, as well as the exhaust steam feed-water heater. The catalogue, which is amply illustrated and contains prices and sizes, will be sent to anyone on application.

Manhattan Electrical Supply Co.

The above well-known company, located at 32 Cortlandt street, New York, have recently issued their new illustrated catalogue No. 10. We have seldom seen a supply catalogue equaling this one in completeness, neatness of arrangement and typography. It lists and illustrates on its 336 pages so large a variety of electrical supplies that it takes four closely printed pages of index to enumerate them. It contains a select list of house furnishing, telephone and telegraph supplies, novelties, tools and electric light supplies. The company have had a very successful career since the formation in 1888 and increased facilities have had to be added from year to year. At that time the total floor space used was 320 square feet. At the present time they occupy over 60,000 square feet. Their factory is equipped with the latest improved machinery, and every labor-saving device that money can buy has been added, which enables them to lessen the cost of their product, and their customers have the benefit of such reduction. They sell all supplies on a small margin of profit above the actual cost of producing same. While they always quote low prices to small buyers, it is a well-known fact that few, if any other dealers reserve as liberal a discount to the jobbing trade as this company. The catalogue will be mailed to any one on application.

The Victor Telephone Manufacturing Co.

ORIGINALITY has marked the goods and methods of the Victor Telephone Mfg. Co., 166-174 South Clinton street, Chicago, Ill., ever since the word Victor became a household word in telephone engineering in this country. Again they have shown this admirable trait in the publication of a very unique and handsome folder illustrating and describing the numerous styles of telephone apparatus and switchboards manufactured by the company. The folder measures 15 by 34 inches and is folded into sixteen pages, printed on two sides and enclosed in an artistic envelope, which bears the names of sender and patron. On one half of the folder are set forth the merits of the Victor metallic switchboards, which are made to any required size by using the Victor transfer or trunking system between each 200 section of switchboard. Other apparatus illustrated are the following: The Victor ideal transmitter, styles "C," "D" and "K" telephones, hollow arm long distance transmitter, box base and flat base arm transmitters, Victor bi-polar receiver, portable desk telephone, magneto, cross-connecting and fuse board, and the non-disconnecting carbon lightning ar-

Digitized by Google

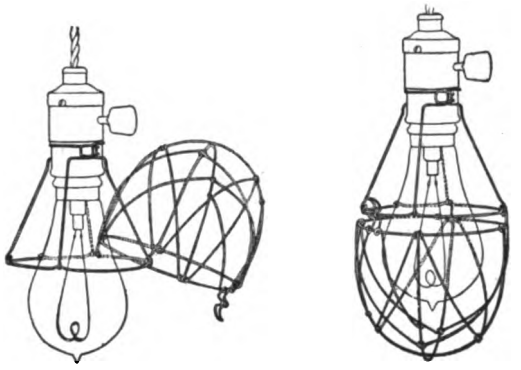
rester and induction absorber. This handsome and useful folder will be sent to anyone on application.

The company's business has been exceptionally brisk of late, and they have placed during the past month a 200 capacity exchange in Mitchell, S. D., including telephones and all appliances; another of 100 capacity, in Bunceton, Mo., also one of 200 capacity in Paxton, Ill., and another of 150 capacity with telephones, etc., in Rantoul, Ill. This company now have orders in their factory, working overtime, for over 1,200 drops, and their goods are meeting with unprecedented favor.

TRADE NOTES AND NOVELTIES

The Inglis Improved Perfection Lamp Guard.

BELOW is shown a lamp guard, recently placed on the market by the Wm. Inglis Wire & Iron Works, Detroit, Mich., which does not possess the objectionable features of most devices of this kind, namely, that of having to detach the guard from the socket in order to handle the lamp. The "Improved



THE INGLIS "IMPROVED PERFECTION" INCANDESCENT LAMP GUARD, OPEN AND CLOSED.

Perfection" guards are made to open and close in the middle, so that the lamps can be cleaned and handled with the greatest possible ease. It is convenient, simple, firm and neat, which will be substantiated by a trial order. Besides this style the company manufacture special types of lamp guards, globe nets and fan guards, all of which are described in a catalogue issued by them, which will be sent on application.

Large Orders for the Sandusky Warren Alternator.

The Warren Electric Mfg. Co., of Sandusky, Ohio, manufacturers of the Warren alternator, advise us of the following orders and business since Aug. 1, 1898: 75 k. w., Fremont, Ohio; 75 k. w., Seabright, N. J.; 45 k. w., woolen mills, Mishawaka, Ind.; 60 and 30 k. w., Elkhart Lake, Wis.; 60 k. w. Columbus, Texas; 75 k. w., Torreon, Mexico; 75 k. w., Lerdo, Mexico; 60 k. w., Huron, Ohio; 150 k. w., North Baltimore, Ohio; 75 k. w., Upper Sandusky, Ohio; 45 k. w., Bowie, Texas; 200 k. w., Martinsburg, W. Va.; 120 k. w., Towanda, Pa.; 100 k. w., Shelby, Ohio; 75 k. w., San Angelo, Texas; 100 k. w., McKinney, Texas; 60 k. w., Fredona, Kansas; 90 k. w., Paragould, Ark.; two 60 k. w's., Waco, Texas; 75 k. w., Newport, Pa.; 120 k. w., Auburn, Ind.; 45 k. w., Charlestown, W. Va. They have contracts on hand for a 150 k. w., Mishawaka, Ind.; two 45 k. w., St. Louis, Mo.; 45 k. w., Standard Oil Co., Whiting, Ind.; 350 k. w. machine and two 10 k. w's. for Armour & Co., Chicago. There are several smaller deals which keep the factory extremely busy. Concerning the deal for Armour & Co., the company state that the 7,000 light machine, as well as the two 3,600 light machines, will each be single-phase of the regular Warren inductor type.

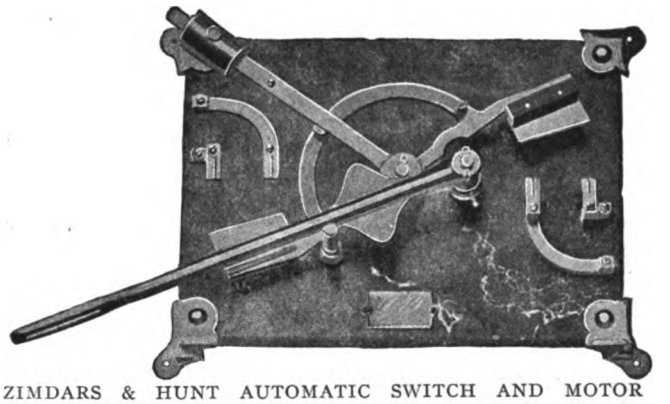
YAZOO CITY, MISS. The Yazoo City Improvement Co., W. B. St. John, superintendent, will soon be in the market for a line of shafting, friction clutches, friction and fixed pulleys, stands, pillow blocks, belting, steam fittings, pipe covering, etc.

Zimdars & Hunt Automatic Switches and Motor Starters.

WITH the introduction of the electric motor into many classes of work there came a demand for some means of automatically starting them. To meet this demand there was early put forward a variety of devices of more or less elaborate and complicated design, some of which, though they answered their purpose for a time, soon came to grief through their designers not having appreciated the severe service to which an article of this kind would necessarily be subjected. Springs, clockwork, magnetism, etc., have all been tried as an operating force with varying degrees of success.

The firm of Zimdars & Hunt, 127 Fifth avenue, New York, after a careful study of the subject, put forward a line of these articles which they believed was free from the many sources of trouble so common to the earlier types. The distinguishing feature of these automatic switches and motor starters is the means employed to operate them, which is gravity alone, a weighted lever furnishing the operating force in all of their types. This, however, is but one of the improvements over the earlier types that is embodied in this concern's devices. The form of contacts used in these primitive types was a fertile source of trouble, and many of them have been condemned for their weakness in this respect alone. In the Zimdars & Hunt types all these older forms have been abondoned for the more modern arrangement of a well-ground knife contact.

Numerous other instances might be cited to show the great amount of care bestowed on the design of these articles, but



ZIMDARS & HUNT AUTOMATIC SWITCH AND MOTOR STARTER.

it is sufficient to say that the extreme care expended on them both in the design and in the construction has extended to the smallest detail.

This firm, besides manufacturing a full line of automatic switches and automatic motor starters for direct current apparatus, are also about to place on the market a line of alternating current automatic switches and starters. In fact, some of their types of these have already been put forward. These alternating current switches will be furnished for all systems, single and multiphase.

Literature covering all the apparatus of this class manufactured by this concern will be furnished those interested, upon request.

Great Improvement in Telephone Apparatus.

We are in receipt of the following from the Western Telephone Construction Co., of Chicago: During the past year or two great improvements have been made in apparatus for central telephone exchange offices. The Newark Telephone Co., of Newark, N. J., has just installed a new central office equipment that is pronounced by experts to possess new and novel features and of an extraordinary nature never before introduced in central office exchange. It does its work so rapidly that a great deal of time and money is saved, requiring fewer operators and at the same time giving better service.

The Newark Telephone Co. is an opposition company to the Bell people, and such is the success of this exchange equipment that the officials of the Bell Co. are simply amazed. This exchange is connected directly with 2,100 local subscribers, and also has connections with sub-stations, giving it a total of over 3,100 connections. As the rentals charged by the Newark Telephone Co. are much less than those charged by the Bell people,

Digitized by Google

the citizens of Newark are to be congratulated on securing cheaper and better service.

The Northern Extending Its Field.

The Northern Electrical Mfg. Co., whose factory is at Madison, Wis., has just completed arrangements whereby its Eastern business will be handled by Messrs. Geo. Hoffman and Theo. Kloman, under the caption of the Northern Engineering Co., with offices at Room 101 Taylor Building, 39-41 Cortlandt street, this city. Mr. T. E. Tyng, who formerly looked after the city business, is also associated with the new office. This new arrangement is consequent upon the rapid growth of the business of the Northern Electrical in the East, and of its determination to give prompt and efficient service to its Eastern customers. The "Northern" has upon the market a full line of steel motors and generators ranging from ½ h. p. to 150 h. p. in both belted and direct-connected types. The gentlemen above named are salesmen of recognized ability, and they will no doubt get their full share of business.

Tabor & Mayer Co.'s Telephone Supplies.

The Tabor & Mayer Co., 506 Atlantic street, Boston, have removed their factory to Yarmouth, Me., where they have doubled on floor space and also in their capacity for putting out complete telephones and telephone parts, which will hereafter be their exclusive business. Their factory is run by water-power and they feel they are in a position of great superiority for the manufacture of cheap high-grade telephone goods.

How the Warren Lamp Got Its Name.

Some time since the Warren Electric & Specialty Co., Warren, Ohio, manufacturers of incandescent lamps, organized a contest for choice of name for their new lamp. The judges have just rendered their decision, and the following is a list of those persons who were awarded prizes:

First prize, $50. PEERLESS. Joe E. Calloway, Pueblo, Colo.; Jno. C. Watson, Charlotte, N. C.; J. W. Freeman, Joplin, Mo.

Second prize, $30. WESCO. K. W. Mansfield, So. Norwalk, Conn.; Gugler Elect. Co., Minneapolis, Minn.; J. E. Calloway, Pueblo, Colo.; H. P. Ayer, Portland, Me.; J. S. Daily, Chillicothe, Ill.; New Orleans Elect. Co., New Orleans, La.; C. J. Wetsel, Chicopee Falls, Mass.

Third prize, $20. LIBERTY. W. H. Schott, Chicago, Ill.; Joe E. Calloway, Pueblo, Colo.; A. D. Scatcherd, Batavia, N. Y.; Chas. Frankish, Ontario, Cal.; Phillip Hickley, Chicago, Ill.

Fourth prize, $10. ALADDIN, AURORA, ECLIPSE, ENCORE. Thos. Day Co., San Francisco, Cal.; D. A. Gill, Kansas City, Mo.; Lemuel K. Cushing, Chicago, Ill.; H. L. Brintnall, Saginaw, E. S., Mich.

New Factory of Williams Abbott Elec. Co.

A visit to the new plant of this concern in Cleveland will well repay the visitor. A representative of The Electrical Engineer had the good fortune to be shown through the establishment by its energetic president, Mr. Lewis Sands. The factory is three stories high. General assembling rooms and general office occupy the first story; also the engine room and planing mill for the manufacture of cabinets, which is located in the rear. The second story is the general machine shop, the electroplating department and testing room. The entire floor space covers several acres, and every arrangement for completeness and convenience has been carefully worked out. It is said that the output of the new plant exceeds 100 magneto bells per day.

Electric Plant for Distributing Refuse on Rikers Island.

What promises to be a very interesting as well as a very novel electric power transmission system is now being installed by the C & C Electric Company upon Rikers Island at the entrance to Long Island Sound, opposite Manhattan, for the R. H. Hood Company, an engineering and contracting firm, also of New York. The Hood Company has the contract for the removal of ashes and similar refuse from Manhattan, which will be used for the purpose of filling up Rikers Island. The ashes will be transferred in scows to the island where they will be unloaded upon conveying belts which will distribute them, all of which work will be done electrically.

The C & C Electric Company will furnish two 250 volt belt-type generators, each of a capacity of 120 k. w. at 525 revolutions, together with the necessary switchboard.

The motor equipment will consist of a 50 h. p. multipolar, and a 40 h. p., a 20 h. p., and a 10 h. p. closed type ironclad motor. Two of these ironclads will be fitted with back gears for driving the conveyors.

A Correction.

Through an unfortunate mistake of our printers we published in our issue of Nov. 17 among our Advertisers' Hints a little paragraph to the effect that the Columbia Incandescent Lamp Co., of St. Louis, had not only made additions to their factory, but had also increased their capital. This is a mistake, as no addition has been made to their capital, nor is any contemplated. What we should have said, was that their capacity was increased 25 per cent. by the new addition to their factory, and we are informed that even with this very substantial increase the company has been compelled to operate the factory at night to keep up with their ever increasing business.

The Cleveland Electric Trading Co.

The Cleveland Electric Trading Company, 806 The Cuyahoga, Cleveland, Ohio, report that they have been enjoying a very prosperous fall trade, in both new and second-hand apparatus. Their shipments of machinery have extended from Connecticut to California, and from Northern Minnesota to Texas. They handle second-hand goods of high grade, either on consignment, or will purchase direct if so desired. They have been having a splendid run on alternating apparatus, arc light machinery and lamps. They are selling agents for some very good lines of supplies and machinery, and are endeavoring to secure their full share of the trade which comes within their field.

They are now arranging to increase their capacity for handling work, both in repairs and second-hand goods, and hope to enter upon the new year with a factory of their own which will be well fitted for handling all classes of electrical work cheaply and successfully.

The Harrisburg Foundry and Machine Company's New Plant.

THE Harrisburg Foundry and Machine Company, located at East Harrisburg, Pa., have been realizing the need for better facilities for carrying on their ever increasing business, for some time past, and it is now announced that the capital stock has been increased so as to make available a fund of $200,000, which will be drawn upon in the construction and equipment of a new plant. Plans designed by Vice-President and General Manager William R. Fleming, have already been prepared, and reveal a most comprehensive, compact and ornate scheme for carrying on the future operations of the company. A tract of five acres of land lying between Emerald street and Reel's Lane and Seventh street and the Pennsylvania Railroad, has been purchased, and upon the southwestern corner of this tract will be built one large brick and steel building, 260 feet long by 140 feet wide, in which will be amply accommodated the various departments of this extensive plant, now occupying six or eight detached buildings on a plot of sixteen acres owned by the company on Vernon street beyond Fourteenth. It is expected to have a portion of the new plant occupied and in operation by March 1st next. It will be built of brick and stone. The shop proper will be located on the first floor, while the second floor will be used for offices and storage purposes. The plans for the new structure are completed and indicate that the big concern will be in operation on this new site within the next year. Instead of having the departments scattered as at present, all will be under one roof. The offices will occupy a space fifty by fifty feet in size. Electric cranes will be installed and every modern device to make the shops the best in the country will be introduced.

The employees now connected with the works will be continued, and from time to time this number will be increased to meet the demands of increasing trade. The concern is in a

Digitized by Google

flourishing condition, having about one-third more orders on hand now than at any time in the history of the company. At present there are orders for forty or fifty engines that have not been filled, showing how the company is pressed with business. The output of the new plant will be one engine a day.

It has been stated that the company may make an exhibit at the Paris Exposition in 1900. Since 1883, when the company entered the field of automatic engine design and manufacture, the company has built 2,500 engines, aggregating fully 300,000 horse power. It now builds 20 different styles of engines varying in capacity from 5 to 3,000 horse power each.

Auxiliary Fire Alarms in Australia.

A copy of the "Scientific Australian," just to hand, has the following: "A highly interesting and successful trial of a new fire alarm apparatus was recently given by the maker, Mr. E. H. Kirkby, of Nelson place, Williamstown, at the head station of the Metropolitan Fire Brigade, Melbourne. The experiments proved that the apparatus fulfills all that Mr. Kirby claims for it. The most interesting feature of the experiments, however, was a trial of the Montauk automatic fire alarm cable, a newly patented American idea. The main instrument was disconnected from the recording apparatus and placed in circuit with the Bouverie Street Station. A flame was applied to the covered cable for a few seconds, and being thermostatic throughout its length, it was at once set in action and registered a prearranged signal at Bouverie street. As a result the hose cart arrived at the head station in under 3½ minutes. This was convincing proof of the usefulness of this cable in conjunction with Mr. Kirkby's instruments. Had this combination been in use in Elizabeth street, Melbourne, in which the recent great fire originated, there is no doubt but that it could have been confined to small limits. The experiments were under the control of Chief Stein and his highly efficient staff of officers, and were an unqualified success."

American Electric Railway Apparatus in Western Australia.

The Perth Tramways Syndicate, of London, England, has a concession for building a tramway in the city of Perth, Western Australia, and to Subiaco, Leaderville and Fremantle, suburbs of Perth, which, when finished, will have a total mileage of between 30 and 40 miles. At present 10 miles are being built in the city proper, part single and part double track. A second 10 miles will be laid on completion of the first section. The road will be 3 feet 6 inches gauge, operated by electricity, and all the equipment will be American, with the exception of the 6-inch girder groove rails now being rolled in England. The power plant will be built to develop 2,300 h. p., the first installation to consist of two tandem compound engines of 350 h. p. each. These are now being built by the Robb Engineering Company, of Amherst, N. S. The Babcock & Wilcox Company, of New York City, will furnish the boilers, which are to have forged steel headers, and be built to accommodate mechanical stokers, should these appliances be desirable when the plant is running at its full capacity. Goubert feed-water heaters and Stratton separators, made by the Goubert Manufacturing Company, New York City, will be used. The pumps and condensers have not yet been ordered.

The electrical equipment, including one 225 k. w. direct-connected generator, will be supplied by the General Electric Company, Schenectady, N. Y. The power plant, as well as the car barn, will be fireproof construction throughout, the latter to accommodate thirty 30-foot cars. An extension to accommodate an additional twenty cars will be added later.

Iron poles for carrying the overhead wires, to be extra heavy and of special design, are now being made by the Pennsylvania Tube Works. Ten American style 18-foot closed cars, with cross seats and centre aisle, have been ordered from the J. G. Brill Company, Philadelphia. They will have Brill trucks and special fittings, and G. E. motors and controllers. Messrs. J. G. White & Co., of 29 Broadway, New York City, are the consulting engineers for the road, and buy and inspect the materials.

ECK DYNAMO AND MOTOR WORKS. Mr. C. A. Eck, 66-72 New Jersey Railroad avenue, Newark, N. J., have installed themselves in a large and well equipped factory as above, and have now better facilities than ever to take care of their increasing business. They have also had to add to their working force.

ADVERTISERS' HINTS

THE AMERICAN ENGINE CO., Bound Brook, N. J., say the first direct-connected electric lighting plant on the island of Santo Domingo is to consist of an American-Ball engine and generator of 25 k. w. capacity.

THE NEW YORK PATENT BUREAU, Albany, N. Y., wish to purchase desirable patents pertaining to the mechanical and engineering trades.

THE WILLIAMS-ABBOTT ELECTRIC CO., 8, 10 and 12 Columbus street, Cleveland, Ohio, devote their "ad" to several styles of their magnetos for telephone use and testing.

THE GARVIN MACHINE CO., New York, call attention to their large and complete stock of machine tools including shapers, tapping machines, screw machines, drill presses, radial drills, engine lathes, etc. These are built in various sizes and styles, and are all described in their new catalogue, which is now ready for distribution.

THE DEARBORN DRUG & CHEMICAL CO., Chicago, Ill., say their saccharated tannins clean boilers without any corrosive action.

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION, 120 Liberty street, New York, present a list of their regular and special courses in electricity. Their "General Course A" provides a popular exposition of all branches of electricity without mathematics. This course is splendidly adapted for the layman and for those who may take up electricity as a pastime.

THE AMERICAN REFLECTOR & LIGHTING CO., Chicago, Ill., advertise a cheap style of deep cone reflector especially desirable where a number are required, such as over reading tables, desks, machines, etc.

GEORGE K. HAMBLIN, 4 Peck Slip, New York, makes a business of renewing incandescent lamps.

WESTERN NOTES

THE ELECTRIC APPLIANCE CO.'S new catalogue of telephone apparatus and telephone construction material, No. 14, is being very well received by the telephone trade and, judging from the orders for telephone material that are being received, is being very extensively used. The Electric Appliance Company claim that they have the most complete catalogue of telephone supplies that has yet been issued and they are glad to supply copies free of charge to the telephone trade.

THE CENTRAL ELECTRIC CO. announce that they will have a great variety of all kinds of portable reading and desk lights. The peculiar adaptation of these types of lamps to so many different purposes has led to a wide variety of types that are adapted to most all conditions. These and many other useful articles will be fully illustrated in their new catalogue which is about ready for distribution.

MOLONEY ELECTRIC CO., St. Louis, Mo., who make the Moloney transformer, have moved into a large four-story factory, and will there enjoy better facilities for their growing business. They have been very busy the past few months, and had to find larger quarters. Their new address is corner of Second and Vine streets.

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, Mo., are putting on the market this season their well and favorably known Monarch lamp, which is the sixth season this lamp has been before the public. They report that this lamp has been kept constantly up to date and every effort made to furnish a lamp that fulfils the wants of station managers. This they believe they have accomplished, as their sales have been extremely gratifying, which they consider evidence of the merits of the lamp.

ELECTRIC APPLIANCE COMPANY. The season for Christmas decorations is always a busy one for the contractor and electric light station manager, as nearly all Christmas decoration now means some kind of special electrical illumination. The Packard sign lamp is designed with a view of meeting the demand for a lamp of uniform candle power, voltage and efficiency for this class of work, and it is now very extensively used

Digitized by Google

for decorative purposes. The Packard sign lamp is a miniature lamp of 2 candle power to be used in connection with a regular Edison candelabra receptacle and of a proper voltage to burn 4 in series on from 50 to 60 volts and 8 in series on from 100 to 120 volts. It is guaranteed of long life and high efficiency. The fact that it is made by the manufacturers of the celebrated Packard lamp should be sufficient guarantee of its high quality. The Electric Appliance Company have these lamps and receptacles in stock at all times, but carry a specially large stock at this season of the year to meet the unusual demand.

MANAGER ESPERSEN, of the Pacific Electric Co., La Crosse, Wis., has just returned from a very successful trip East selling their well known specialties. Their factory is working day and night to catch up with orders.

TREASURER DICKEY, of the Dayton, Ohio, Globe Iron Works, says their business is excellent. Among their recent orders for water wheels have been some for electrical transmission power plants in Japan and Europe.

WOODSFIELD, O., has voted to issue bonds for an electric lighting plant, which will be installed at once. W. H. Pelton, Room 806 The Cuyahoga, Cleveland, O., is the electrical engineer in charge. Plans and specifications may be obtained from him, or from Mr. George P. Dorr, Corporation Clerk, Woodsfield, O.

THE GENERAL ELECTRIC CO. has established a sales office in the Templeton Building, Salt Lake City, Utah. It is in charge of Mr. H. E. Chubbuck.

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, Mo., have recently made arrangements with one of the largest and best known foundries in the country to handle their gears and pinions, and are now in an excellent position to furnish them at factory prices. They solicit correspondence and believe they can make it an object to managers of electric railways to correspond with them and secure their prices before placing their orders elsewhere.

DENVER, COL. The May shoe and clothing store in Denver, Co., is now brilliantly illuminated throughout by 130 General Electric enclosed arc lamps of both the single and double globe type. The use of these lamps for store and window lighting is steadily increasing, as the advantages they present over other means of illumination become better understood.

CHESTER, ILL. The Gordon Telephone Company has been formed with a capital stock of $5,000. A. G. Gordon is president and treasurer; E. R. Gordon, manager. The other incorporator is Clarice Gordon. An equipment of Stromberg-Carlson make has been put in with 100 drops. There are 80 subscribers, 60 miles of circuit in town, and 8 miles of toll line. Surrounding towns will be reached. The rates are $1.50 and $2 per month.

CLEVELAND, O. The International Fac-Similigraph Co. has been formed at Cleveland with a capital stock of $25,000 to make devices for the electrical transmission of photograph plates.

WESTERN ELECTRIC CO. has distributed a bulletin giving a full description and price list of the Western Electric non-sparking brushes. These brushes are very satisfactory in eliminating the sparking at the commutator. Upon request a copy of this bulletin will be sent to anyone who has not received one.

NEW YORK NOTES.

NEW YORK EDISON CO. shows earnings for October, 1898, of $253,897 gross and $100,800 net. The results for ten months show a gain in gross of $466,326 and in net of $151,931.

AM. GRAPHOPHONE CO., Bowling Green Building, New York City, exhibited on Nov. 23, an improved graphophone, embodying the work of Mr. T. H. Macdonald. The sound was wonderfully full, clear and sweet. The mechanism was not shown.

NEW YORK SUBWAYS. Excellent authority is quoted for saying that the Metropolitan Street Railway Company has made a very advantageous arrangement with the Consolidated Subway Company for the use by the latter company of the spare ducts of the former, which no longer denies that it has spare ducts. Indeed it is now said that they "were built with the express understanding that they would be used for electric lighting and power."

NEW ENGLAND NOTES

MR. C. R. FISH, who has for years been associated with central station work in New England, has recently gone into business for himself, with offices at 113 Devonshire street, Boston, and will carry on a general electrical supply business, in addition to handling electrical apparatus, engines, boilers, etc. Mr. Fish is well known in New England, and will doubtless meet with deserved success in his new field.

CONTENTS.

EDITORIALS:
The Agitation Over Street Car Brakes 538
A Non-Mathematical Treatment of the Rotatory Converter..... 538
Electric Power on Warships 539
Return of the Volunteer Engineers 539

TELEPHONY AND TELEGRAPHY:
The Postal Telegraph Co.'s Caravan (illustr.)..... 529
Government Pay Telephone Stations in Paris 530

ELECTRIC TRANSPORTATION:
Surface Contact Electric Railways—II. (illustr.)..... Edward H. Johnson. 530
The Electric "Moto-Vehicle" .....C. I. Woods. 531
The New Heilman Electric Locomotive (illustr.).—Electric Railroading in Japan.—Proposed Electric Consolidation in Baltimore, Md. 533
The First Train of Bonner Rail Wagons (illustr.).—Data from Poor's Manual of Railroads for 1898..... 534

POWER TRANSMISSION:
High Voltage Power Transmission—II. (illustr.)....Chas. F. Scott. 535

NEWS AND NOTES:
Proposed Combination of Leading Electric Elevator Interests 537

LETTERS TO THE EDITOR:
Prof. Dolbear on Mr. Tesla and His Work.....A. E. Dolbear. 540

ELECTRIC LIGHTING:
A Sturtevant Diminutive Generating Set (illustr.) 540
New G. E. 220 Volt Enclosed Arc Lamp (illustr.)..... 541
One Way of Finding a Short Circuit (illustr.).....A. E. Dobbs. 541

EDUCATIONAL:
The New Electrical Equipment at McGill University, Montreal... 541
Massachusetts Institute of Technology.—The Michigan College of Mines 542

MUNICIPAL AFFAIRS:
The "Municipal Plant" of Knowledge (illustr.)..... 542

MISCELLANEOUS:
Governmental Matters Affecting the Export and Import Electrical Trade 542
On the Electrical Properties of the Vapors from the Carbon Arc... Ernest Merritt and O. M. Stewart. 544
Exports of Electrical Material from New York..... 544

SOCIETY AND CLUB NOTES:
American Institute of Electrical Engineers.—Connecticut Street Railroad Association.—The Electrical Exhibition Co.—The New York Electrical Society 545

PERSONAL:
A Gold Medal from Omaha.—Prof. Röntgen to Go to Leipsic.—Mr. Herrman Herberts 545
Mr. A. M. Young.—Mr. Albert Rhett.—Mr. H. H. Vreeland..... 546

MARRIED:
McGorkle—Howard 540

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Nov. 17, 1898.. 546

LEGAL NOTES:
Alternating Current Meter Patents 546

THE STOCK MARKET:
A Thanksgiving Situation 546

CATALOGUES:
Painting to Prevent Corrosion with Specifications.—Western Electrical Supply Co.—Lombard Water Wheel Co.—Whiting Foundry Equipment Co.—Frink's Patent Reflectors.—The Turner Oil Filter and Waste Cleaning Machine.—The Westinghouse Electric Turn-Table "Donkey."—Mechanical Draught for Steam Boilers... 547
Improved Brush Arc Lamps.—Julius Andrae & Sons' Co.—George M. Mayer Model and Machine Works.—Gould's Efficient Power Pumps.—M. R. Rodrigues' Baby Motors.—Hoppes Steam Separators and Oil Eliminators.—Manhattan Electrical Supply Co.—The Victor Telephone Mfg. Co. 548

TRADE NOTES AND NOVELTIES:
The Inglis Improved Perfection Lamp Guard (illustr.).—Large Orders for the Sandusky Warren Alternator.—Zimdars & Hunt Automatic Switches and Motor Starters (illustr.).—Great Improvement in Telephone Apparatus..... 549
The Northern Extending Its Field.—Tabor & Mayer Co.'s Telephone Supplies.—How the Warren Lamp Got its Name.—New Factory of Williams-Abbott Electric Co.—Electric Plant for Distributing Refuse on Riker's Island.—A Correction.—The Cleveland Electric Trading Co.—The Harrisburg Foundry and Machine Co.'s New Plant 550
Auxiliary Fire Alarms in Australia.—American Electric Railway Apparatus in Western Australia.—Advertisers' Hints.—Western Notes 551
New York Notes.—New England Notes 552

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. DECEMBER 8, 1898. No. 553.

The Hamilton, Can., Cataract Power Co.'s Plant at De Cew Falls.

BY GEORGE W. BOWIE.

THE starting of this plant is an event that all the prominent hydraulic and electrical engineers in Canada have been looking forward to for some time past with interest on account of the many novel features embodied in its construction. The engineers selected for this purpose to conduct, design and overcome the obstacles which arise with a departure from the customary methods, to suit location, conditions, etc., are well known, and occupying the front rank in their respective professions, as men of unquestioned ability, as proven by the result of the "formal opening" and celebration on the 12th of November at the power house, at De Cew Falls, three miles from St. Catharines, of the transmission of electrical energy to the City of Hamilton, 34 miles distant.

The celebration was participated in by members of the Ontario

LAKE MOODIE.

Legislature, business men of Hamilton, hydraulic and electrical engineers, from widely scattered points of the Dominion of Canada and the United States, who were there to witness the termination of a stupendous work and the successful culmination of the hopes of the directors and stockholders of the Cataract Power Company, of Hamilton.

It has been proved beyond a question of doubt, that for simplicity, economy and profitable results, water power can often outbid steam, and is by far the most satisfactory method yet known of utilizing nature's forces for the comfort and welfare of the people adjoining those water powers, with its applications to the industries necessary for the employment of the human race.

THE CANAL.

Beginning with the canal along which the water flows for creating this electrical energy, the water is admitted into the company's canal from the Welland Canal at Allanburg, four miles distant from the power house, and is admitted at the same elevation as the water of Lake Erie. In the Cataract Power Company's canal the water is carried to the brow of the mountains at the De Cew Falls, where the canal terminates with massive concrete walls. Along the line of the canal are three lakelets covering a space of 30 acres (known as Lakes Moodie, Gibson and Patterson, respectively), with a capacity to keep the plant running 48 hours, if repairs should be found necessary along the water-way at any point.

This part of the work showed the skill and perseverance of

AQUEDUCT ACROSS VALLEY.

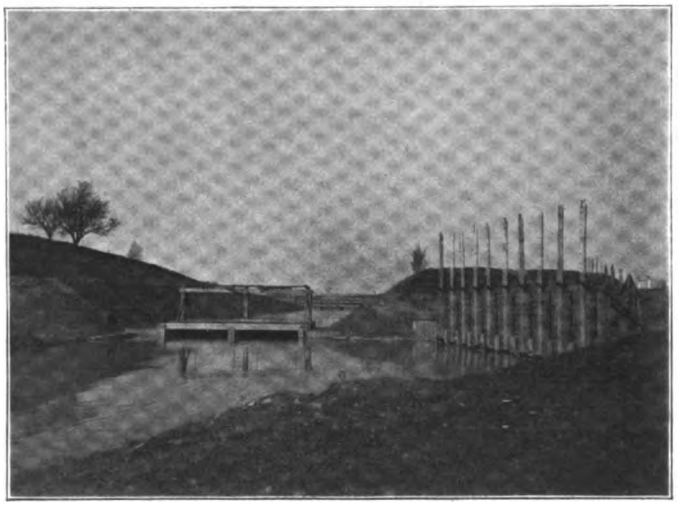
the engineers, Mr. W. Kennedy, Jr., of Montreal, consulting engineer for the company, and Mr. T. J. Hillman, resident engineer, in overcoming natural obstacles and adapting the contour of the country, through which the canal passed, to attain their object.

FEEDER PIPE.

Overlooking the brow of the mountain where the canal ends, you look down the slope on which rests the leviathan steel feeder pipe, which conveys the water to the turbines. The pipe has capacity for 10,000 h. p., and the water flows through it with a velocity of three feet per second, when supplying 6,000 h. p.

The upper end of the pipe is buried beneath a mass of concrete, which embeds, or anchors itself, in the interstices of the rough rock, on each side and the bottom, and holds the upper end or top of pipe, anchored and immovably fixed to the end wall of the canal.

The pipe is approximately 700 feet long outside of the power



HEADGATES AT ALLANBURG.

house, and the various lengths and thicknesses of plate used in its construction are as follows:

286 feet, $^{9}/_{16}$ inch thick; diameter, 8 feet.
100 feet, $\frac{3}{8}$ inch thick; diameter, 7 feet, 6 inches.

Digitized by Google

71 feet, 7/16 inch thick; diameter, 7 feet.
231 feet, ½ inch thick; diameter, 6 feet, 10 inches.

At the end of this last diameter is the beginning of the elbow which enters the power house, and gradually enlarges in diameter within a radius of 35 feet from 6 feet 10 inches diameter to 8 feet 6 inches diameter of steel plate ¾ of an inch thick, to enable it to stand the pressure of 113 pounds to the square inch, also the fluctuating pressures arising from street railroad service.

Inside the power house the feeder pipe is 70 feet long, and is gradually reduced in diameter as it approaches the last wheel, it then being 6 feet 6 inches diameter. It terminates in a cone,

PIPE LINE AT CUT THROUGH HILL.

whose smallest end is 12 inches diameter, and is extended to feed two 35 h. p. turbines which run the exciters.

The feeder pipe on the circular and vertical seams is double rivetted, the longitudinal seams are triple rivetted; all rivets are 1⅛ inch diameter, and all seams are butt strapped.

To compensate for the variations of length of such a long pipe, due to the extreme heat and cold of summer and winter, midway up the slope is situated an expansion joint, whose maximum movement from change of temperature will be about 6 inches.

THE POWER HOUSE.

This is a substantial structure, composed of skeleton iron work, filled between with brick. The dimensions are: Length, 174 feet; width, 42 feet; height to apex of roof, 38 feet. The floor is of solid concrete, 12 inches thick, with a surface layer of cement 3 inches thick, and the interior of the building is abundantly supplied with light from its numerous windows, as shown in the illustration.

The visitor on entering the power house is at once impressed with the symmetrical arrangement of the generators, water turbines, transformers and switchboards, and the brilliant illumination from 200 incandescent lights.

The water turbines, as being next in sequence of description, are as follows: There are two Victor water wheels (with provision for two more), and in connection with this plant the significant feature is that the descent is 260 feet from head water to tail water. The wheels are special 44 inches diameter, the journal bearings are 7⅜ inches diameter, and run at 400 revolutions per minute, while at a test made a few days ago, one of the wheels developed 1,800 h. p. The water is admitted to the wheel from a cylinder gate, which is encircled with water in a water jacket around the case of the wheel.

The water wheel or hydraulic part of the plant is isolated from the generators with a 3 inch space between the couplings (which connect the water wheel and the generator) by leather links, whose studs are alternately fastened to each half of the coupling, thereby preventing the current from grounding through the water wheel.

There are many salient points worthy of observing in connection with this hydraulic plant—high head, high speed, all necessitating a high safety factor in its construction, and a departure in design from the usual routine of water wheels situated between the turbine and the branch pipe. Coming through the floor from the main feeder pipe is a 36-inch gate valve, which in the operation of opening and closing has to slide against a pressure of 60 tons, making a full movement in 25 seconds.

It consists of a vertically placed cylinder, whose piston is affixed to the gate valve disc by rods, and by the admission of water above or below the piston, at 113 pounds pressure to the square inch, the gate valve is accordingly raised or lowered. To prevent rupture or water hammer, each gate valve has attached a relief valve with a spring adjustment. The relief valve is also brought into service when large loads are thrown off or on the generator.

Each unit is provided with a momentum wheel on the turbine shaft, which weighs 7½ tons, constructed out of steel plate, the rim of the wheels being made from whole plates with the interior cut out and two whole plates being left intact to form the web. In this manner is obtained a momentum wheel that practically cannot fly asunder from centrifugal force.

The onlooker is impressed when looking at the water wheels and generators attached, with the massive and substantial nature of the mechanical equipment, which runs so smoothly, without jar or tremor of any description, on account of the perfect alignment and balancing of the revolving parts. Each water unit weighs about 60 tons.

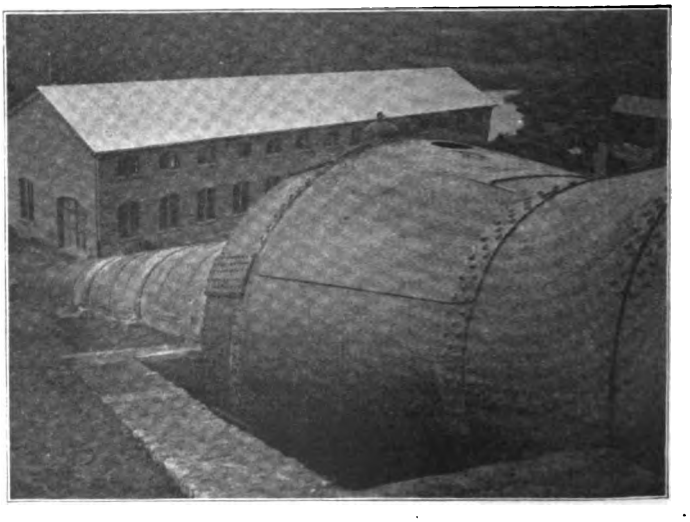
One of the most interesting features in connection with the plant is the Giesler mechanical-electrical governor, which regulates and keeps a practically steady speed on the water wheels and generators, irrespective of amount of change of load. The hydraulic plant, including power house, feeder pipe and water turbines, with their attachments, was designed by Mr. A. C. Rice, mechanical and hydraulic engineer, Dayton, Ohio.

To facilitate the handling of such heavy machinery there is an overhead travelling crane of 15 tons capacity.

THE ELECTRICAL INSTALLATION.

This consists of two S. K. C. two-phase inductor type generators (built by the Royal Electric Co., Montreal, P. of Q.); rated capacity, 1,000 kilowatts at 2,400 volts; weight, 60 tons each. These machines are run in parallel, and supply current to 10 step-up transformers, which raise the voltage to 22,000.

The transformers are of 200 k. w. capacity each, and are of the oil-insulated, water-cooled type. They feed the main line to Hamilton, consisting of four No. 1 B. and S. gauge hard-drawn bare copper wire, supported on the poles on triple petticoated porcelain insulators, every one of which was tested at 60,000 volts before being used. At Hamilton the current is received at a transformer sub-station, where the pressure is reduced to 2,250 volts by oil-insulated, air-cooled transformers. It then goes to the distributing switchboard, from which it feeds



EXPANSION JOINT IN PIPE LINE.

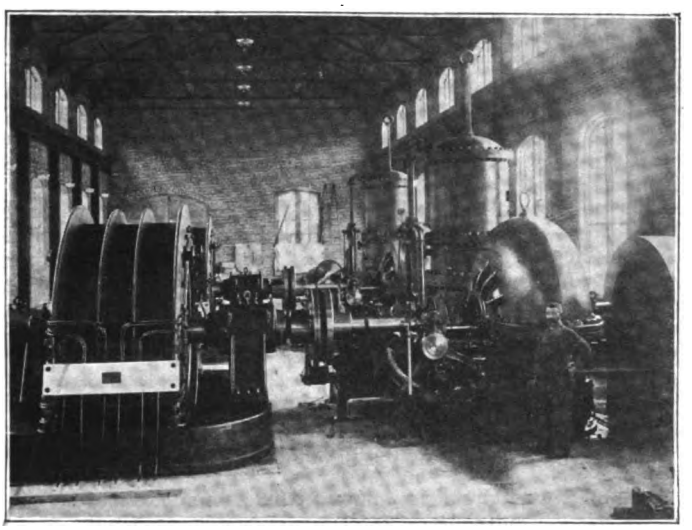
the lighting and power circuits throughout the City of Hamilton. Details are given below separately.

The exciters are rated at 30 k. w. at 70 volts, and run at 1,000 revolutions.

Digitized by Google

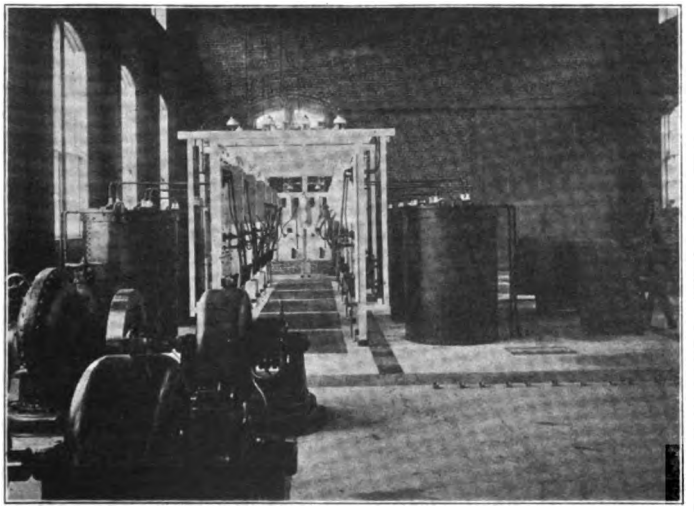
SWITCHBOARD DETAILS.

The main switchboard, as is shown in the cut, is made up of three white marble panels, one for each generator and one for the exciters. On the generator panels all the connections are made on the back of the boards, there being no bare terminals



INTERIOR OF POWER HOUSE.

on the face. The switches are of the slide quick-break type, and are provided with automatic shutters to prevent arcing. They are double throw, connecting to two separate sets of bus bars, so that the machines may be run on separate lines or in parallel, according to the future requirements of the service. Each generator panel contains a voltmeter with a double-throw switch connected to both phases, an ammeter on each phase and a direct current ammeter in the field circuit of the generator. The cases of the instruments are made of ground glass and present a very attractive appearance. No fuses are placed on the generator, as with this type of machine it is considered safer to risk the overload due to a short circuit rather than have the load constantly removed entirely from the water wheels by the blowing of fuses. The exciter panel contains the usual instru-

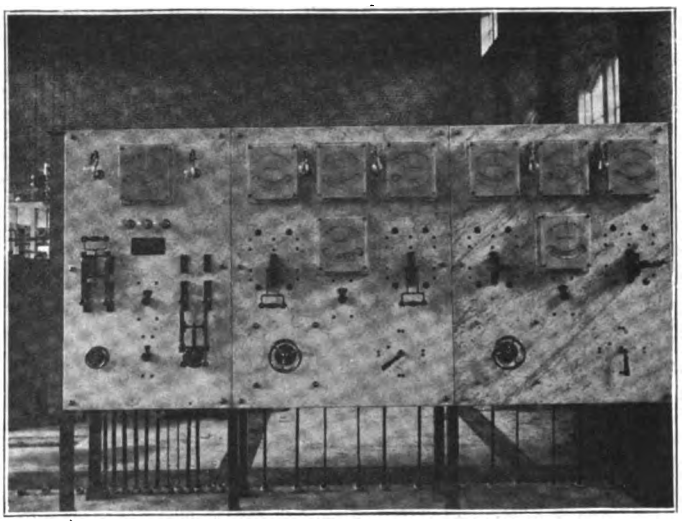


EXCITERS, EXCITER WHEELS, TRANSFORMERS AND SWITCHBOARD ALLEY.

ments for operating two shunt-wound machines in parallel, and also contains a synchronizer which is of the ordinary three-lamp type.

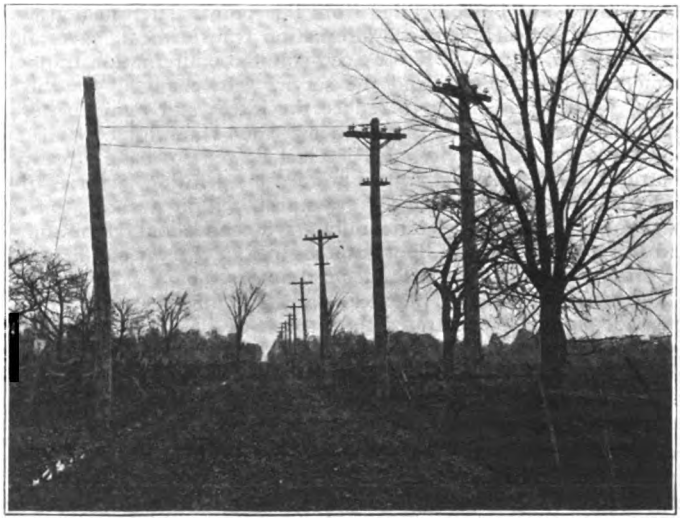
Immediately back of the switchboard is the space, taking up one end of the building, occupied by the step-up transformers. These transformers, of which there are ten, are arranged in batteries of five, each transformer having a capacity of 200 k. w. They are artificially cooled by means of water pipes supplied direct from the pen stock, the pressure being reduced by means of throttle valves. The transformers are encased in tanks made of steel boiler plate, and rest directly on the concrete floor. The coils are wound in sections, carefully insulated and separated by extraordinary air space, and the whole immersed in mineral seal oil. This construction has been found to answer admirably the purpose of this exceedingly high voltage, each transformer being tested with a break down strain of 40,000 volts before being installed.

A novel feature of the installation is the switchboards which accompany each transformer. They are of specially selected white marble, and contain two single-pole high voltage switches and one double-pole 2,000 volt switch. The two high voltage



SWITCHBOARD AT POWER HOUSE.

switches are separated by a marble barrier. The 22,000 volt switches consist of a flexible cable having a screw plug attached to one end and a socket to the other, the socket being attached to a hard wood pole 4 feet in length for safe handling. The socket and the plug which it fits over are tipped with non-arcing metal. By means of these specially connected switches the 22,000 volt circuit can readily be opened, although in practice it is usual to throw load off the transformers by means of the low voltage switch, so that the high voltage switch is only required to break the leakage current of the transformer. The low voltage switches are of the back-of-the-board slide type. Each transformer is also equipped, on both the primary and secondary



POLE LINE LOOKING TOWARDS HAMILTON.

sides, with non-arcing fuses. The 2,000 volt wires inside the building are all covered with a specially heavy insulation of rubber, and are supported on porcelain line-insulators on an overhead rack, all being in plain sight and easily accessible.

Digitized by Google

THE TRANSFORMING ARRANGEMENTS.

From the transformers, which are connected five in parallel on each phase, the circuit runs to the line terminal board, consisting of four high voltage switches similar to those placed on the transformer switchboards, except that they have double terminals, in order that they may be changed to either of the two lines contemplated by the company. Immediately above the line terminal board is placed a specially constructed lightning arrester, composed of 60 S. K. C. non-arcing 2,000 volt arresters, connected in triangular form. From the lightning arrester the wires pass upward and out through the wall of the building at a height about 30 feet from the floor.

The company's step-down station is located at Victoria avenue, immediately beside the Grand Trunk Railway's right of way, about one mile within the city limits. It is a neat structure, built of brick with slate roof, and specially designed for this purpose. At this point the voltage is reduced to 2,000 volts, at which pressure the current is distributed through the city in four separate circuits.

The line wires are carried through the brick walls of the building in the same manner as at the power house. There is the same arrangement of lightning arresters, high voltage lines and two batteries of transformers. The transformers, however, are arranged so as to be artificially cooled at times of heavy load by means of an air blast. The transformers rest over an air duct in the floor and are provided with a ring of vertical air ducts passing up through the oil. The blast arrangement, which consists of a No. 6 Sturtevant blower, direct connected to a two-phase induction motor, delivers air directly into this duct, which then passes upward through the transformers.

In the transformer room is also placed the distribution switchboard and, as at the power house, only half the ultimate capacity of the transformers has been installed, the building being designed to accommodate two more batteries of five, similar to those already placed, consisting of four panels each, containing two ammeters, two double-pole double-throw switches and four duplex fuse blocks. One circuit which supplies the incandescent lighting current for the Hamilton Electric Light & Power Co., is placed on a separate bank of transformers in order to keep the incandescent service distinct from the motor circuits. From the switchboard the circuit wires pass upward to a cupola in the roof, at which point they are joined to the distribution circuits. The line supplying the incandescent service is a four-wire, two-phase circuit, but the circuits devoted exclusively for power are composed of three wires only.

At the premises of the Hamilton Electric Light & Power Co. is being installed a new circuit switchboard, arranged to accommodate the old single-phase lighting circuits of this company. Each circuit is equipped with a double-throw switch, in order that the load may be balanced between the two phases, and each phase is provided with a regulating transformer, in order that the pressure may be controlled from this point. The old house-to-house 1,000 voltage, 16,000 alternation transformers, have all been replaced by new S. K. C. 2,000 volt, 8,000 alternation transformers in larger units, and the service all changed to this higher pressure, in order to reduce the losses and retain better regulation. In addition to supplying the Hamilton Electric Ligt & Power Co.'s service, the Cataract Power Co. have already contracted for a large amount of power for operating factories of different kinds in the city. They expect, within a short time, to supply the various electric railways in and about Hamilton, and to replace nearly all the steam engines in the various manufacturing establishments with electric motors.

The plant has been in practical operation for several months, and thoroughly demonstrated the success of electrical transmission at this high voltage and long distance, which speaks well for the carefulness in designing and construction of the work.

THE TRANSMISSION LINE.

The high voltage wires are carried through the brick wall forming the gable end of the power house, by means of lead-covered rubber cable, protected by vitrified pipe, the cable being kept clear of the pipe by wooden bushings specially prepared in oil. After crossing over a cross-arm attached to the building the lead-covered cable is joined to the bare copper transmission wires, by means of a long, carefully made, waterproof joint. This special construction has proven entirely satisfactory.

From the power house the transmission line crosses the Twelve Mile Creek and runs up the hill opposite on private property, to a concession road, thence along this roadway due north to the Grand Trunk Railway, and then westward along the railroad right of way on an almost perfectly straight line to the company's step-down station at Hamilton, a total distance of a little less than 34 miles. The transmission wires are four in number and are No. 1 B. & S. medium drawn copper. They are all placed on one four-pin cross-arm, 3¾ x 5¾ inches, spaced 18 inches apart, and are supported on porcelain insulators of the Redlands type, supplied by the Imperial Porcelain Co. The pins are of special design, holding the insulator two inches higher from the cross-arm than the standard practice. This is to avoid trouble from heavy snow or sleet. The pins are of yellow locust, specially prepared in oil, and are fastened into the cross-arm with a wooden pin instead of being nailed, so as to use as little iron as possible.

The poles are all specially selected, 8 inches at the top and not less than 35 feet in length. They are set 90 feet apart and 6 feet deep in the earth. The height of the pole varies with the contour of the ground, so as to keep the wires as nearly horizontal as possible. At marshy places, a crib filled with stone is built around the base of the pole, and where the line crosses the Jordan River, the poles are placed in a cluster of piles specially driven for the purpose. On the top of the poles is run a galvanized iron barbed wire, grounded at every pole by means of an iron plate for lightning protection. Below the transmission cross-arm is placed a two-pin cross-arm carrying the telephone circuit.

The telephone circuit is a complete metallic circuit of No. 10 B. W. G. galvanized wire, transposed at every fifth pole. This arrangement has been found to give satisfactory service with the heaviest currents yet passed over the line.

The insulators were all carefully tested with a break-down pressure of 60,000 volts, both at the factory and again at Hamilton, before being put up, with the satisfactory result that not one has broken down, or produced the slightest trouble in the three months during which the line has been in operation, notwithstanding the unusual rain and sleet storms during that period. The line was constructed by Messrs. Lowe & Farrell and is a very creditable piece of work.

PERSONNEL OF THE WORK.

The contractors and engineers engaged in this work are as follows: Messrs. Macdonald & Sutherland, canal excavations and brick work and foundations in power house, Messrs. Stillwell, Bierce & Smith-Vaile Co., Dayton, Ohio.

Feeder pipe and frame work of power house (built by Hamilton Bridge Works) designed along with the hydraulic plant by Mr. A. C. Rice, engineer for the Dayton firm, who contracted for all the iron work and machinery. It was erected under the supervision of Mr. Geo. W. Bowie.

The generators and electrical appliances were furnished by the Royal Electric Co., of Montreal, and were erected under the supervision of Mr. W. C. McLaren.

The credit of this scheme is due to Mr. Jno. Patterson, who realized the possibility of and the benefit to be derived from the development of this enterprise for the industries of Hamilton.

The capital of the Cataract Power Co. is $1,000,000, and it is organized as follows: Hon. J. M. Gibson, president; Mr. James Dixon, vice-president; John Moodie, secretary-treasurer; Jno. Patterson, secretary; H. R. Leyden, general manager; Directors, Jno. L. Dickenson, J. W. Sutherland, Jno. Knox, J. J. Wright, of Toronto; J. A. Kamarar, of Toronto.

Niagara Power Development in Canada.

Official notice is being published in the "Canada Gazette", that the Canadian Power Company will apply to the Parliament of Canada, at its next session, for an act to extend its time for the completion of its works, to extend the bonding powers of the company, and to more particularly define its powers and to change its name.

The name of this company should not be confounded with that of the Canadian Niagara Power Company, which latter company has exclusive rights in Queen Victoria Niagara Falls Free Park, and is controlled by the Niagara Falls Power Company. The two men who are prominent in the Canadian Power Company are Banker Paine, of Niagara Falls, Ont., and Mr. A. C. Dennison, of Philadelphia.

ALBANY, N. Y., has voted down in common council the Stevens proposition for a municipal lighting plant.

Digitized by Google

High Voltage Power Transmission.—III.[1]

BY CHAS. F. SCOTT.

HIGH-TEST TESTS AT EAST PITTSBURG.

LABORATORY tests and measurements on a small scale cannot take the place of tests under the conditions of practical service, such as those at Telluride. There are, however, many important elements which may be determined by laboratory measurements.

A high-tension line for testing insulators and making measurements upon the losses between wires was erected at the East Pittsburg factory in the fall of 1897. A number of the tests which have been made are here recorded:

(1) A test was made to determine whether the wave form of the charging current to the line was similar to that through a resistance, or whether it was modified by the loss component, the loss occurring only at the higher part of the e. m. f. wave. The current to the high-voltage line, at pressures varying from 30,000 to 60,000 volts, was passed through a coil possessing high self-induction. The e. m. f. upon the coil was measured by a voltmeter. The e. m. f. was also measured when a current of equal strength was passed through the coil, the line being short-circuited and a low e. m. f. applied. It was found that the voltage upon the coil was the same, within a small error of observation, in both cases, showing practically no difference in the wave form of the current under the two conditions. The current was from an armature giving practically a sine wave.

(2) The charging current to the line was measured under several different conditions when the current was obtained from a generator giving practically a sine wave. The results of measurements were compared with the currents as calculated by the theoretical formula. The last measurement in the table was made upon the Niagara-Buffalo line, with current from a Niagara generator, which differs slightly from a sine wave.

COMPARISON OF MEASURED AND CALCULATED CHARGING CURRENT TO PARALLEL WIRES. LENGTH, ONE MILE—10,000 VOLTS.

Size of Wire.	Distance between Wires.	Frequency.	Meas. Current, Amperes	Calculat'd Current, Amps.
No. 8 B and S	21.7"	60	.0307	.028
8 B and S	48.0'	60	.0245	.0252
8 B and S	79.5"	60	.0234	.0238
8 B and S	127.5"	60	.0225	.0222
No. 8 and ground	120.0"	60	.0427	.0412
0.71" diameter	18" for ⅔ of distance 36" for ⅓ of distance	25	.0176	.0176

(3) The fall of potential around the wires was noted by tests made with spark-gaps. The wires 48 inches apart were connected to the high-voltage terminals and a spark-gap was placed between two idle wires also 48 inches apart, placed about 21 inches below the first wires. A spark-gap consisting of brass terminals with a ¼ inch radius was placed between two idle wires. When the gap was 1-32 inch the sparking began when the e. m. f. from the raising transformer was 26,000 volts. A gap of 1-32 inch requires an e. m. f. of 2,200 volts to produce sparking. When the spark-gap was made 8-32 inch (equivalent to 12,000 volts) the sparking began at 103,000 volts from the raising transformer. At intermediate points there is a fair proportionality between the spark-gap and the e. m. f.

In another test a spark-gap was placed between one of the idle wires and the adjacent wire of the live circuit. When the spark-gap was ⅛ inch (equivalent to 6,000 volts) the spark passed when the e. m. f. was 17,500 volts, and when the spark was made ¼ inch (equivalent to 12,000 volts) the sparking began at 33,000 volts. When the gap was ⅜ inch (equivalent to 16,000 volts) sparking began at 41,000 volts. When the gap was ½ inch (equivalent to 20,000 volts) sparking occurred at 49,000 volts. The e. m. f. did not differ greatly from a sine wave. These tests have an important bearing in connection with the running of telephone and other circuits adjacent to high potential wires. It is essential that the wires of a high-potential circuit be spiraled so that each wire sustains the same relation as every other wire to the second circuit, in order that the effects of static induction may be neutralized.

(4) The effect of the size of wire upon the loss was investigated by running a pair of No. 28 brass wires 0.0126 inch in diameter and then replacing it by large rubber-covered wires. The rubber-covered wire was No. 7 B. & S. gauge 0.144 inch in diameter; the outside diameter of the rubber covering was 0.3 inch and the diameter over the braid was 0.35 inch. In each case measurements were made upon another circuit which was unchanged during the different tests, and thus served for comparison. The loss is greatly decreased when the rubber-covered wire is used. The loss on the rubber-covered wire, however, increased considerably after the voltage had been raised and the rubber had broken down, thus permitting the current to pass freely to the outer surface of the insulation. It is quite probable that the loss would increase as the insulation became defective, until it was nearly equal to that of a wire having the same total diameter.

(5) The effect of the current in drying the surface of the insulators was illustrated in a test made during a rain. Upon applying 45,000 volts to a circuit the wattmeter indicated 116. After four minutes the deflection had decreased to 72, the current remaining the same. The e. m. f. was then increased to 60,000 volts, the wattmeter deflection increased to 155, and at the end of three minutes it had fallen to 138. The current was one-third greater than at the lower voltage, but remained constant while the wattmeter changed. The rain continued during the test, which shows, therefore, that the condition of the insulator is materially improved by the presence of the current.

(6) It was noticed that when there was a break-down upon the line and the current passed suddenly between wires over the surface of the cross-arm that there was a sparking between the terminals of the ammeters in the high tension circuit across the surface of the instrument. This was further investigated by placing in circuit a coil of low resistance through which 1 ampere would be sent by about 1½ volts at a frequency of 125. A spark-gap was placed in shunt to this coil. A 2 inch spark-gap was also placed between the line wires. The voltage of the primary was gradually raised until at 35,000 volts the current passed across the spark-gap between the line wires. A spark also passed across a gap of ⅜ inch, shunting the small choke-coil. This test shows the remarkable suddenness of the rush of current when the short-circuit occurs due to the breaking down of the spark-gap on a high-voltage circuit. This phenomenon was observed by Mr. Mershon in choke-coils used in connection with lightning arresters at Telluride.

Running tests were made on four lines in multiple at high voltages. Each line consisted of two wires 1,040 feet in length held by 26 insulators. The insulators were of various types of glass and porcelain, some of the ordinary form and some underhung. For hours at a time 100,000 volts or slightly more were kept upon the line. For about six weeks voltages ranging from 70,000 or 80,000 to 100,000 volts were kept on the lines for about eight hours a day. When there was rain the line would short-circuit and the voltage had to be reduced. During a driving rain storm 48,000 volts was kept on the lines, and it may have required a considerably higher voltage to have caused short-circuiting.

(7) A high-tension wattmeter similar to the Thomson wattmeter at Telluride was used. To correct the wattmeter for the errors caused by charging current in the shunt resistance, a condenser was placed in parallel to the shunt circuit of the wattmeter. This condenser should be so adjusted that the current through the shunt circuit of the wattmeter is the same that it would be if there were no condenser and the shunt resistance had no capacity. This permits the capacity current in the circuit to be shunted round the wattmeter by the condenser. The condenser in shunt to the wattmeter was capable of adjustment, and by varying its capacity the deflection could be made positive or zero or negative when current was delivered to a constant load. The proper adjustment was made by taking a comparatively low voltage, at which the charging current was very high in comparison with the loss, so that the loss was nearly negligible, and adjusting the wattmeter to indicate zero. At higher voltages, when there was a considerable loss, the error with this adjustment would be inappreciable. Certain variations with temperature and humidity were noted which would be explained by a variation in the capacity of the resistance, causing a variation in the charging current to the shunt circuit of the wattmeter. The high resistance for the shunt circuit was wound upon fullerboard plates containing brass stiffening pieces. Tests were made upon individual plates by measuring the capacity between the

[1]Abstract of a paper read before the 15th general meeting of the A. I. E. E. Omaha, June, 1898.

Digitized by Google

wire and the supporting strip of brass, and it was found that the capacity and the insulation resistance both varied with the amount of moisture in the fuller-board insulation. In order to prevent variations of this kind, subsequent resistances were wound upon glass plates, which seems to be a very satisfactory form of construction.

TESTS AT NIAGARA.

Some measurements have been made upon the Niagara-Buffalo transmission line. There are two circuits of three wires each, one of the which was in service and the other was available for tests. Each circuit consists of three cables each of 350,000 c. m., approximately 0.7 inch in diameter. The cables are run on porcelain insulators, and are on the same cross-arm. Adjacent insulators are 18 inches apart and the circuit is spiraled, so that each of the three wires occupies the middle position for a third of the distance. Current from one of the 5,000 h. p. generators was applied to the line through a raising transformer, by which the voltage can be increased by small steps to 100,000 volts.

Measurements were made between the various pairs of wires, i. e., 1 and 2, 2 and 3, and 1 and 3; the current was found to be

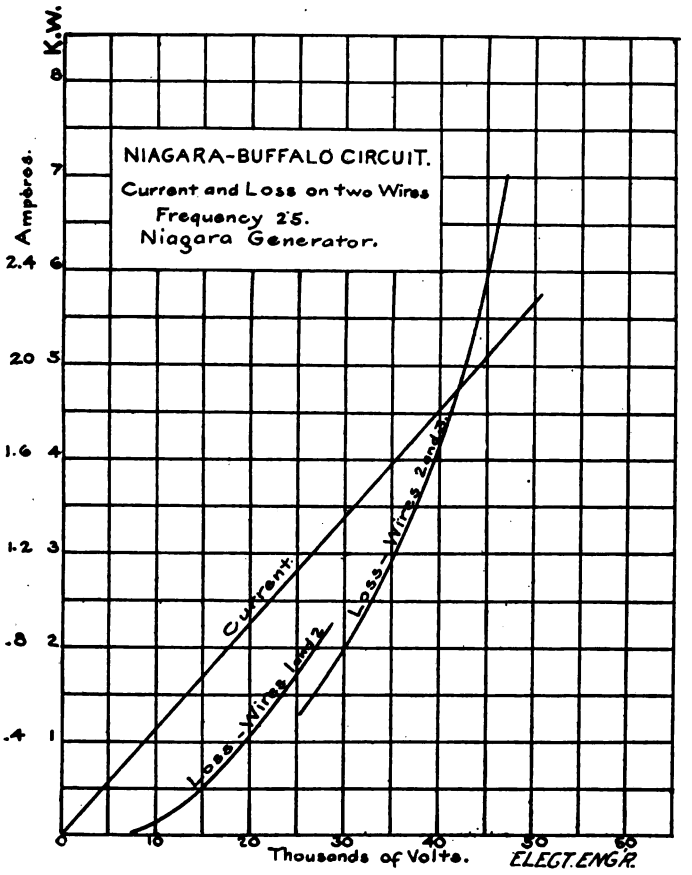


FIG. 4.

practically the same in each case; the loss on one of the circuits was slightly greater than that on either of the other two, on which the losses were about equal. The accompanying curve shows the measurements of current when two wires were connected and the measurement of loss; the latter measurements were made upon one pair of wires up to about 26,000 volts and then upon a second pair. The results are given in Fig. 4.

On another day measurements were made of the resistance between each wire and the ground, and corresponding measurements of loss were made by placing the high potentials between each wire and the ground. The measured loss was somewhat greater than the loss calculated by using e. m. f. and the measured resistance. In these measurements, at voltages from 13,000 to 23,000 volts, the power factor calculated from the current and wattmeter measurements, varied from about 4 per cent. to 6 per cent., so that a very small charging current in the wattmeter would produce a considerable error in the reading.

Some measurements were made upon a pair of fine wires, in which the wires were placed at different distances apart. No. 31 B. & S. gauge spring brass wire 0.0089 inch in diameter was used. The length of the parallel wires was 774 feet. They were suspended by light strings successively at 6 inches apart, 14 inches apart, and about 25 inches apart, the distance varying from 24 inches to 27 inches. The power factor of the measurements made above 100,000 volts is about 95 per cent., and is over 80 per cent. above 70,000 volts. There can be but little error in the wattmeter due to charging current in the resistance at these power factors.

The measurements on the Buffalo line were made by the writer. Those on the fine wires were made by Mr. E. M. Tingley, who conducted the tests at East Pittsburg, and rendered valuable assistance in the preparation of this paper.

POWER TRANSMISSION PLANTS IN OPERATION.

Beginning with the plant at San Bernardino and Pomona, which began operation in 1892, using 10,000 volts and transmitting 30 miles, a constantly increasing number of plants have been installed operating at 10,000 or 15,000 volts. In some cases there has been little or no trouble experienced with the transmission lines, while in other cases the experiences have been less satisfactory. The principal trouble seems to have been a poor grade or an insufficient size of porcelain insulator. In other cases the insulators, sometimes porcelain and sometimes glass, have given almost perfect satisfaction.

The superintendent of a power company which has been running fifteen months with about 15,000 volts, reports that they "have had absolutely no trouble whatever of an electrical nature." Some insulators were broken because they had been used as targets by small boys or hunters, but only the outer petticoats were broken, and no short-circuits occurred, although in some cases insulators were in use for months with most of the outer petticoats chipped off. The distance of transmission is 12 miles. Porcelain insulators are used.

In another plant which has been in operation about a year and a half employing 15,000 volts for a distance of nearly 30 miles, there have been but three shut-downs on account of line difficulties. These were due to the breaking of insulators at a point where the line was spiraled. In one case the repair was made in half an hour, and in the other case a few minutes' interruption to the service was sufficient for repairs.

The line is regularly patroled, and if a defective insulator or pin is found, the generating station is notified by telephone and the line is shut down for a few moments at noon. In one case two poles were burned by a defect in the insulators on the top of each. The poles burned to the ground, leaving the wire hanging clear without any one at either the generating station or substation being aware of the fact.

Troubles have arisen on some lines by the burning off of pins by the passage of sparks from the outer edge of the insulator to the pin. These sparks make small holes in the pin no larger than a needle point, but after continuous sparking for some time the pin becomes entirely charred. An iron pin suggested itself as a remedy, but additional strains and liability to break-down are liable when a conductor is placed within the insulator. The burning off of pins has occurred where small porcelain insulators are porous and the outside glaze is imperfect, while the glaze on the inside is good. When the porcelain is filled with water the current readily passes through it to the lower rim of the insulator and then sparks across to the pin. In one place which has been running for about three years some 250 pins burned off. The early insulators have been replaced by larger and better ones, and this defect has disappeared.

A 10,000 volt-line which runs for a dozen miles or more within a few hundred yards of the Pacific coast has burned cross-arms on nearly every pole. The cross-arms near the ends of the line, which are away from the coast, are not burned. Usually the burning appears as a mere blackening of the cross-arm for a short space between the insulators, on one side of the arm. In some cases the charring is deeper, and appears on both sides. The side on which almost all of the burning occurs is the one toward which the winds come from the ocean, bearing the mist of salt water. The wire shows discoloration, and the iron braces for holding the cross-arms are in a few cases eaten through. Moreover, the cross-arms were green and full of sap when erected. The early porcelain insulators were porous, and have now been replaced, and the pins are of iron. The charring has ceased almost entirely since the new porcelains were put up.

It may be observed that in the plants which are herein referred to and in the experimental tests, no mention has been made of insulators with cups containing oil for reducing the surface leakage. Insulators of this kind were used in the Frankfort-Lauffen

Digitized by Google

experimental transmission line at 30,000 volts. Practically, however, the surface insulation is adequate without oil cups and the principal duty of the insulator is to prevent the current passing over the surface and jumping to the pin or cross-arm, a matter with which the oil would have nothing to do.

Telephone lines are in use in a number of plants placed on the poles which carry the transmission wires. The telephone lines are usually placed some distance below the transmission wires and are crossed at frequent intervals. The telephones in general work very satisfactorily.

ELECTRIC LIGHTING.

A Gas Engine Electric Lighting Plant for the French Chamber of Deputies.

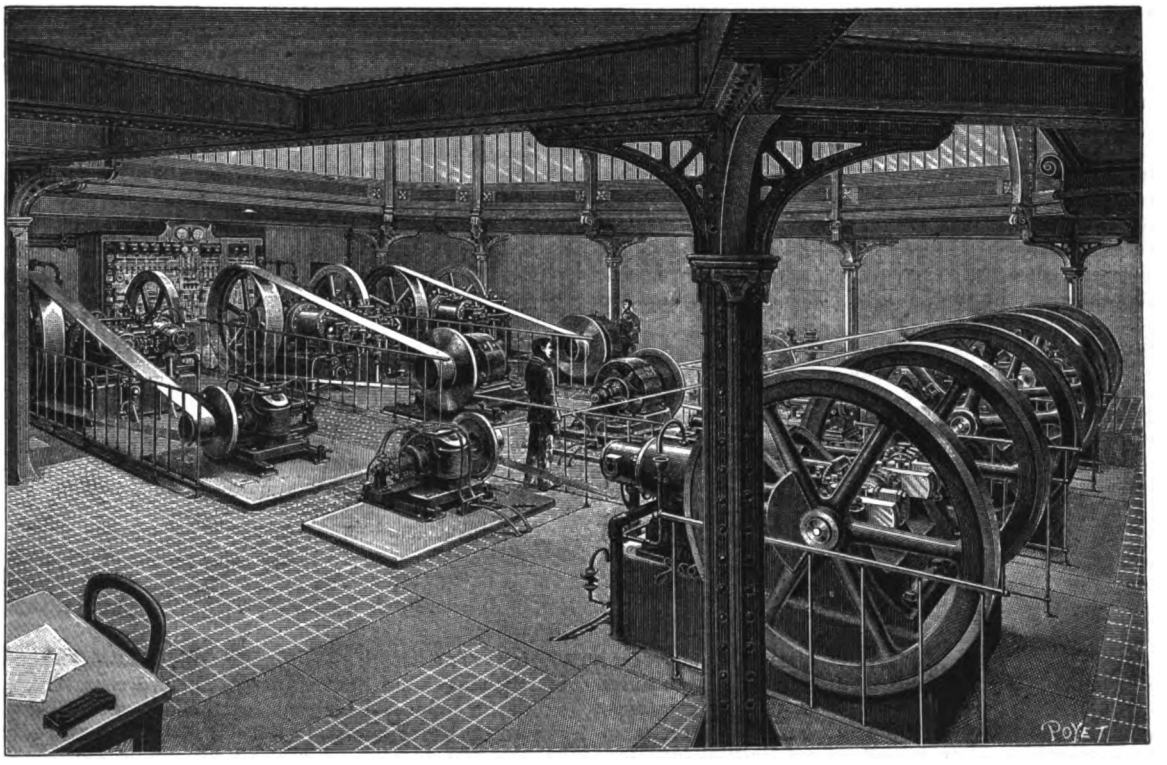
SINCE the month of October the French Chamber of Deputies, at Paris, has been lighted by electricity, through the instrumentality of a very large gas engine plant. The work has been done by the firm of Jean & Bouchon, under the guidance of a commission, of which M. Mascart was president. The plant comprises no fewer than 4,610 lamps, distributed throughout the building, aside from the Chamber itself. A new and larger Chamber is being constructed, and this will be lit by arc lamps placed above a transparent septum in the ceiling, after a manner that is familiar in this class of work. Resort was made to gas engines because of the many objections presenting themselves against a steam plant under all the circumstances. The space available was a small open court, and the plant occupies a floor space of only 17 metres by 25, being covered by a glass roof which lights it by day.

The gas engines were built specially for the work by the Paris Gas Co., at their Saint Denis shops. They are of the Lenoir type, with two cylinders. The plant comprises, as shown in the cut, two of these gas motors of 30 h. p., running at 150 revolutions, and four motors of 50 h. p., running at 65 revolutions. Provision has been made to allow of the substitution of two more 50 h. p. motors for those of 30 h. p., and to add two new motors, so as to bring the total capacity up to 400 h. p. Each motor is cushioned on a bed of cork, in order to prevent any vibration being felt in the building. Gas is brought to the plant by two pipes 162 mm. in diameter, and each goes to a meter equal to 600 jets, with a consumption of 84 cubic metres per hour. The escape of the gas is first into expansion chambers at each cylinder, and then into two other expansion chambers, on each group of three motors; and in this way there is absolutely no noise from the exhaust. The motors are kept cool by a constant circulation of water, which, after flowing around the expansion chambers, can be discharged into the sewer or is raised by an electric pump to be used for heating and other purposes.

The engines are connected by belts to 6 dynamos, furnished by the house of Postel Vinay. Two of these dynamos are 4-pole machines, with a voltage of 110 to 160, at 600 revolutions per minute; two 4-pole, 50 h. p., at 120 volts, and two 2-pole, Manchester type, 30 h. p., at 120 volts and 875 revolutions per minute. The fields are of soft steel and the armatures are toothed. The 30 h. p. machines have drum armatures of the old Siemens type. The commutators are heavily insulated with mica, and carbon brushes are used. All the dynamos can be run for several hours at full load without a rise in temperature of more than 25° above the atmosphere.

The cables from the dynamos are led to a marble panel switchboard, 3 metres high and 4 long. At the base are the rheostats and an auxiliary resistance in the "motor" circuit. The upper part of the board is occupied by Arnoux and Chauvin meters, switches, circuit breakers, etc. The whole plant is self contained. To start up a gas engine, current from the battery of accumulators to be mentioned later, is thrown into the dynamo to which the engine is connected. The dynamo operating temporarily as a motor and its speed being governed by the "motor" resistance already referred to, the gas engine is set in motion by it. As soon as the engine has thus been brought up to speed, the accumulator current is cut off, the gas is let into the engine and exploded as usual, and thereupon the erstwhile electric motor is duly run in its regular capacity as a generator. It is found that at 120 volts a current of 120 amperes is required for 20 seconds to thus bring the 50 h. p. gas engine up to speed. The gas is also ignited by current from the accumulators; 1 ampere at 4 volts being taken during a very short period of the stroke of the piston.

The storage battery consists of 64 Tudor accumulators, each of 13 positive plates and 14 negative, with an output of 1,250



GAS ENGINE ELECTRIC LIGHTING PLANT FOR THE FRENCH CHAMBER OF DEPUTIES.

Digitized by Google

ampere hours. The battery is controlled by special apparatus for charge and discharge, and by the instruments pertaining to it on the switchboard. The cables, etc., in the plant are placed in tile conduit or on porcelain insulators.

The tests that have been made with this plant show a consumption of 1,000 litres of gas per kilowatt hour of current delivered to the circuits, and the price of the current consumed is rated at .045 franc per hectowatt hour, which is said to be very low for Paris, and is equivalent to 4½ cents per k. w. hour.

We are indebted for our details of this large and interesting gas engine plant to an article in "La Nature," by M. Joseph Laffargue, who speaks very highly of the installation and the results.

The Mechanical Plant of a Modern Commercial Building.—I[1]

BY WILLIAM H. BRYAN, St. Louis, Mo.
(Member of the Society.)

THE modern commercial building is, in many respects, an engineering structure. The problems of foundations, design of frame and walls for the desired loads and wind pressures, the plumbing and sanitary arrangements, call for engineering skill of the highest order. This paper, however, will be confined to the discussion of the mechanical, steam and electrical plants, which are of fully equal importance.

It is now generally admitted that no features of the modern building stand in greater need of consideration by specialists. Such treatment has always been desirable, and is more so to-day than ever, on account of the wide variety of service required, and the improvements which are constantly being made.

These considerations involve, first of all:

The boiler plant, which necessitates the determination of the average and maximum requirements of all the steam cylinders and other steam-using apparatus in the building. It also involves consideration of the characteristics of the fuel and water to be used, the selection of the type of boiler, the smoke flue and chimney, and usually the prevention of smoke.

Next in importance comes the question of power development and distribution; its average and maximum amounts; whether steady or fluctuating. Which of the many types of modern steam engines shall be adopted; the number and size of units; whether high or low speed; simple or compound; condensing or non-condensing; direct-connected or belted? Shall the power be distributed by shafting, belting, rope-drive, electricity, compressed air, or what not?

The lighting system comes next in importance. In these days illumination by electricity is almost a foregone conclusion. Shall the current be supplied from a central station, or generated within the building? Shall the lighting be by arcs, or incandescents; or if in combination, how distributed? Shall motors be driven from the same apparatus? What system of distribution shall be employed; what voltage—110 or 220; what character of current—direct, alternating? If an isolated plant is installed, what shall be the number and size of units; shall they be direct connected, or belted; what as to their general characteristics? Shall the units be independent, or shall they be connected by some scheme of shafting or clutches? What switchboard facilities are necessary? What indicating and recording instruments, switches, safeties, etc.? Shall the arc lamps be of the open or enclosed type, operated in series or multiple? What voltages, efficiencies, and candle powers shall be employed for the incandescents? What shall be the general character of the wiring, its percentage of drop, and its subdivision into sections for independent control by switches?

The elevator system is a feature of prime importance. How many elevators shall there be; where located? How many passenger, and how many freight; how many auxiliaries, such as dumb waiters, ash-hoists, etc.? What shall be the elevator loads and speeds? How shall they be driven? If by steam, whether belted or direct? If of the hydraulic pattern, shall they be high or low pressure; with horizontal or vertical cylinders? What type of pumping machinery shall be used—the old style direct-acting duplex with simple high pressure cylinders; the same engine fitted with compound cylinders; the simple, crank and flywheel pattern; or the more modern compound or triple-expansion crank and flywheel "high duty" engine? Shall it be provided with condensers? If the elevators are to be operated by electricity, at what voltage? Direct or belted; how counterbalanced, and provided with what automatic and safety devices?

The heating and ventilating systems are by no means of least importance. Shall the system be hot air, hot water, or steam, or a combination of them? If hot air or indirect, shall it be by the natural, or hot blast system? If hot water, shall it be natural circulation, or by pumping? If by steam, what shall be the pressure carried, the type of radiation, its amount and distribution? What system of piping shall be employed? How many changes of air per hour are required, and shall it be by natural or forced circulation?

Very closely allied to the heating plant is the steam pipe system connecting the boilers, engines, pumps, heaters, receivers, etc.; with their accompanying valves, regulators, covering, blow-offs, etc., forming in a large building a very complicated system, permitting the utilization of the exhaust from the engines and pumps for heating. The general arrangement of this work, and the selection of the proper apparatus, all demand the most careful study.

The above may serve to indicate that the problems under consideration involve a wide range of engineering experience and research, and necessitate the reaching of conclusions in regard to many matters on which there is room for divergence of opinion.

The author submits with some diffidence the methods employed in designing the equipment for a large building recently constructed in St. Louis. It is not claimed that they involve anything particularly original, or that any special or unusual difficulties were encountered. It is offered simply as an example of what is believed to be good current practice.

The building is constructed of brick and stone and is of the character known as "standard slow combustion," as defined by the Board of Fire Underwriters. It is owned by the Commerce Realty Company, and is situated on the north side of Washington avenue, about midway of the block between Ninth and Tenth streets. Its ground space is 109 feet front by 225½ feet deep, and it is eight stories high, besides basement. The tenants are the Hargadine-McKittrick Dry Goods Company, an old established wholesale firm, located for many years at the southeast corner of Eighth street and Washington avenue, occupying a building of less than half the floor area of the new one. These facilities having become inadequate for their business, arrangements were made in the fall of 1897 for the erection of a new building. The architects of the new building were Messrs. Eames & Young, of St. Louis, who, at an early stage of the work, called into association with them as advisory and consulting engineers, the firm of Bryan & Humphrey. Ground was broken November 16, 1897, and the work was pushed urgently when the weather permitted, and for part of the time, night and day. The tenants moved in on June 1, 1898, partial service from the mechanical plant being then available, and complete service being furnished shortly thereafter.

The work of preparing detailed plans and specifications was taken actively in hand about January 10, 1898, and they were completed and sent out about February 1st, bids being asked for until noon, February 16, 1898. They embodied the following divisions:

First: The "Notice to Bidders," indicating the time and place of receiving bids; the manner of their preparation, whether on single or combined sections; each bid to be in good faith, not requiring later approval; the bids themselves to become the property of the purchaser, and not be returned. The tenders were to be made on proposal forms which were given the bidders, and not on their regular forms.

This was followed by the "General Provisions," covering the conditions under which the different divisions of the work were to be executed, such as replacing of unsatisfactory work and material; supervision; the decision of disputed points; compliance with laws, ordinances, and underwriter's rules; changes, how made; damage done to building by contractor; course to be pursued in case of failure or delay by the contractor; time of beginning and completing the work; deduction for delay in completion; services of expert; standard of excellence, where special makes of goods are mentioned by name; guarantee of one year on all parts of the work; accuracy of data furnished, contractor being required to verify same and see that the plant went together properly; the requirement of bond; and terms

[1]Abstract of paper read at the Nineteenth Annual Meeting of the A. S. M. E., New York, Dec. 1898.

Digitized by Google

of payment. As nearly every section required foundations, a paragraph was added covering once for all the character of foundation required, the method of conducting the work, etc. The foundations, by the way, were to be built of concrete, of Atlas or Empire American Portland cement, one part of which was mixed with three parts of sand, and four to five parts of crushed macadam, cleaned and screened.

Following these come the different sections of the work itself, as follows:

SECTION A—THE BOILER PLANT.

Steam was required in this building for three purposes: Heating, lighting and elevator service.

As shown later, the maximum amount of steam required for heating was about 250 boiler horse power. Careful computations showed that more than this amount would be necessary for the lighting and elevator service, even with the most economical steam engines. As there would always be a surplus of exhaust steam available for heating, it was evident that the heating requirements need not be considered further as a factor in determining boiler capacity.

The maximum electrical requirements are shown later herein to be about 150 kilowatts—exclusive of the elevators—or about 200 electrical horse power. Assuming a combined efficiency of engine and dynamo unit, from steam cylinders to switchboard, of 80 per cent., the maximum indicated horse power is 250. Using simple steam engines at a water rate of 40 pounds per indicated horse power per hour, the steam requirements would be 10,000 pounds per hour. Or, for compound engines at 28 pounds of water per indicated horse power per hour, 7,000. These being divided by 30 to reduce them to boiler horse power, give us 333 for the former, and 233 for the latter.

The efficiencies above assumed, are not, of course, accurate, nor is the statement of the unit of boiler horse power; but they are believed to be sufficiently close for the present purpose, in view of the impossibility of determining accurately in advance what the work will be, and the further fact that the plant would rarely be operated under conditions favorable to the highest economies. The boiler horse power required to operate the elevators is shown later to be as follows:

For steam elevators, 67 indicated horse power, at 100 pounds water rate, ÷ 30	223
For hydraulic elevators, with simple duplex pumps, 75 indicated horse power, at 100 ÷ 30	250
For hydraulic elevators, with compound steam pumps, 75 indicated horse power, at 60 ÷ 30	150
For hydraulic elevators, with high duty pumping engines, 75 indicated horse power, at 28 ÷ 30	70
For electric elevators, with dynamos driven by simple engines, 75 indicated horse power, at 40 ÷ 30	100
For electric elevators, if driven by compound engines, 75 indicated horse power, at 28 ÷ 30	70

The following table shows some of the combinations which were possible, all of which were under serious consideration. It will be seen that the maximum steam requirements for electrical and elevator service might vary all the way between 303 and 583 boiler horse power.

	H. P.
Compound dynamo engines and electric elevators	303
Compound dynamo engines and hydraulic elevators, driven by high duty pumping engines	303
Compound dynamo engines and hydraulic elevators, driven by ordinary duplex compound pumps	383
Simple dynamo engines and electric elevators	433
Compound dynamo engines and steam elevators	456
Simple dynamo engines and hydraulic elevators, driven by compound duplex pumps	483
Simple dynamo engines and steam elevators	556
Simple dynamo engines and hydraulic elevators, driven by simple duplex pumps	583

After due consideration it was decided to ask for proposals on three boilers, each having a rated capacity of 6,000 pounds of water per hour, with feed-water at 212 degrees into dry steam of 125 pounds' pressure above atmosphere, equivalent to 181.7 horse power each, at the Society's standard of 30 pounds from feed at 100 degrees Fahr. to steam at 70 pounds, gauge pressure. Each boiler was to be capable of doing this work continuously with natural draught under regular working conditions, and of being over-worked one-third time in emergencies. It was assumed that this capacity would probably take care of the building; two boilers being operated regularly, and the third being held in reserve for cleaning or repairs, or used on rare occasions of unusually large demands. There was, at that time, considerable doubt as to whether the owners could be induced to put in the most economical type of apparatus. The capacity was purposely stated in pounds of water to be evaporated per hour, rather than in horse power, so as to avoid discussing the question of heating surface per horse power adopted by the different makers.

The Effect of Fire Damp on Incandescent Lamps.

Messrs. H. Couriot and J. Meunier have been making experiments on the effect produced by fire damp of mines when introduced into electric incandescent lamps. In one case the lamp was 10 c. p., the current .8 ampere, and the pressure 45 volts; the filament ceased to be incandescent except when a rupture occurred; when there was a spark, but no explosion. The same result was observed with lamps using larger currents. Messrs. Couriot and Meunier say that incandescent metallic filaments are powerless to produce explosions in the most explosive mixtures.

MISCELLANEOUS

The Volunteer Engineers and the Engineers' Club.

Col. Eugene Griffin, commanding the First Regiment of U. S. Vol. Engineers, has addressed the following letter to John Thomson, Esq., president of the Engineers' Club, in reference to the reception prepared for the regiment on its landing from Puerto Rico:

"Headquarters First Regiment U. S. Volunteer Engineers,
Army Building, New York City, Nov. 30, 1898.

"To Mr. President of the Engineers' Club, New York City.

"Dear Sir: On the delivery to us of our regimental colors by the Engineers' Club, I tried to express the thanks of the regiment and our appreciation of the beautiful flags which had been presented to us. Again our thanks are due for the magnificent reception accorded us upon our return from Puerto Rico. Unfortunately the weather conditions did not permit us to carry out in their entirety the plans as arranged, but we none the less appreciate your work in our behalf and the kindly interest in this regiment manifested by the Engineers' Club ever since our organization.

"We have been regarded as the military representatives of the engineering profession among the Volunteers, and as such have tried to uphold the dignity and reputation and standing of our profession. The reports of those officers under whom we have served show how well we succeeded.

As an engineer regiment we especially appreciate the good will of the Engineers' Club and in behalf of the officers and men of this regiment I tender our heartfelt thanks for all that you have done for us. Very sincerely yours,

(Signed) "EUGENE GRIFFIN,
"Colonel, 1st Regt. U. S. Vol. Engrs."

Pulp Bleaching at Muncie, Ind.

The Muncie (Ind.) Pulp Co. is preparing to make a $40,000 improvement on its plant there. It will be in the form of a system of dynamos which will be used to bleach the pulp wood instead of the present process of boiling it in vats. This will prevent the pollution of streams and many damage suits and will add greatly to the capacity of the big works. The idea is an entirely new one, the invention of a New York man.

MR. GEORGE CRAIG, of the Detroit, Mich., Opera House, has been getting some pretty and novel effects, as its electrician, in the way of lighting, thunder and lightning, etc.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico, - - - - - -	per year,	$3.00
Four or more Copies in Clubs (each), - - - - - -	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies, - - - - - - - - - - - -	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1888.]

Vol. XXVI. NEW YORK, DECEMBER 8, 1898. No. 553.

Our Export Trade.

THIRTY years ago the total export of American manufactures was $60,000,000 in the depreciated currency of that time, or expressed on a gold basis, only $45,000,000. In 1888, the total had risen to $130,000,000, and in 1898 it has become not less than over $291,000,000, or a nearly sevenfold increase within one short quarter of a century. On the other hand, within ten years, despite a 25 per cent. increase in our population, the import of manufactures has fallen off 30 per cent., and for the present year has at last fallen below the export of manufactured goods, being only $229,990,000.

These are surely most significant figures, and justify one in reversing an old axiom or adage, by saying that our flag is only following our trade, for all this has been done when we had neither colonies, nor protectorates, nor possessions, and when our ships upon the sea were sadly few and far between. Can one doubt that under the new conditions of national control where we have hitherto enjoyed no rights and have been granted scant privileges, the trade figures will soon be even more strikingly in our favor? As Launcelot Gobbo, in "The Merchant of Venice," remarks sententiously, "This making of Christians will raise the price of hogs;" and this creation of new American citizens and new American markets is all in the way of developing and benefiting the manufacturer whose vision was but lately narrowed down to a home market of only 75,000,000 people.

When we come to analyze the figures of this export trade, they are very encouraging for such industries as the electrical, engineering and mechanical with which this journal is connected For example, in 1868, the United States exported no scientific instruments; this year we have exported $2,770,803; in 1868 we sent abroad of horse cars and carriages, $404,072; this year the figure is $1,946,231. In 1868 our export of copper and its manufactures was $479,488; this year is has reached the gigantic figure of $32,180,872. Our export of iron and steel has risen from $8,352,466 in thirty years to $70,367,527. For some years past, in spite of the fact that many American electrical manufacturers have factories in Europe, electrical exports have been growing enormously, but have not been deemed worthy of a sharp, separate classification. But our pages recently, week by week, have shown how large that class of exports has become. This country is now being visited by merchants and others in large numbers seeking American electrical apparatus or agencies to handle it.

For these and other pertinent and obvious reasons, we have deemed it fit to utilize our coming New Year Number for the further promotion of export electrical trade. No effort will be spared to help such trade, and the co-operation of the whole industry is invited toward this end. What can be done in any particular region of the world is indicated by the data relative to South Africa. The first nine months of this year show a gain in our exports to South Africa of 13½ per cent., and in the same period those from England to that section fell off 12½ per cent. Five years ago our exports thither were under $5,000,000 a year; now they touch $20,000,000. These exports include $83,000 for steel rails and $31,197 for telegraphs, telephones and other instruments. Our exports to South Africa are now nearly six times what they were in 1868, and the growth is but an encouragement for further and stronger effort.

Two Presidential Addresses.

TO be elected president of a scientific society of high standing, and particularly of a representative body of engineers, is justly looked upon as a well-deserved honor and a reward for long service or noble achievement. A man thus honored by his professional colleagues must necessarily hold either a high place in some particular branch of his chosen profession and be known as an authority thereon, or be a master of the entire profession, evidenced by the great variety and practical value of his work. These qualifications of a candidate evidently give great weight to his utterances as president and for that reason some presidential addresses may be classed among the permanently valuable contributions to technical literature. We have before us to-day two presidential addresses which are of special interest to the electrical engineer on account of the prominent part which electricity plays in each. In the one case in particular the electrical engineering profession can feel justly proud in having one of its members, namely Mr. Wm. H. Preece, chosen as president of the Institution of Civil Engineers of Great Britain. It is the address delivered by Mr. Preece in assuming the duties of that important office which we have chosen to contrast, in a measure, with the masterly address of Mr. C. W. Hunt, upon his recent retirement from the office of president of the American Society of Mechanical Engineers.

These two addresses, though differing widely in their scope and manner of treatment, contain nevertheless statements which may well form the basis of comparison. The address of Mr. Preece strikes one as particularly narrow in regard to some of the views expressed and their applicability to Great Britain only, its elementary and statistical character and several misleading statements. Mr. Hunt's address on the other hand, is broad in its scope, embodies views which would find a distinct echo in every civilized country and covers ably and consistently every branch of the enginering profession. It is worth while to compare briefly their views on questions of a similar nature and see wherein the American and Englishman differ or agree, and how far the conditions applicable to the country which the one represents can be applied to that of the other.

The first feature in common in both addresses which appeals to one is the prominence which both speakers give to electrical engineering. Mr. Hunt makes mention of two of Mr. Edison's inventions among five which he cites as great and monumental works of engineers and has a chapter relating to the engineer's environment, where he mentions the wonders of the Röntgen rays, the galvanometer and the minuteness of the currents which it indicates, the Niagara electric generator of five thousand horse power, the work of Hertz and Marconi's wireless telegraphy, electric locomotion and metallurgy and the uses of electricity on board of ships. Mr. Preece in a most edifying and inspiring peroration, showing us how "electricity opens to our view Nature's secret storehouses, presenting us with new elements, new facts and new treasures" tells us that "though its followers are now regarded as specialists, the period is not distant when it must cease to be a specialty. Every engineer must ultimately become an electrician; and electricity will be the most general, the most useful and the most interesting form in which he applies the fundamental principles of energy to the wants, the comforts and the happiness of mankind."

The next question mutually discussed is that of the education of the engineer and calls forth the following condemnatory words from Mr. Preece: "Our educational methods have begun at the wrong end. We ought to teach the masters first and then the men. Moreover, we have to teach the teachers and those who control the purse strings." He then refers to the lack of practical experience possessed by the majority of professors and tells us that "the ideal professor of pure abstract science is a very charming personage, but he is a very arrogant and

Digitized by Google

dogmatic individual, and, being a sort of little monarch in his own laboratory and lecture room, surrounded by his devoted subjects, his word is law and he regards the world at large, especially the practical world, as outside his domain and beneath his notice. He is generally behind the age. These are not the men for technical institutes." This may be true in England, and we trust only partially so, but it is certainly not true in the United States. Our professors deserve in general the esteem of their pupils due to the thoroughly practical knowledge which they impart. They are in a position to do this as a result of practical training previous to assuming the duties of professor and their later tours of inspection, purchase of modern apparatus and the trips during their sabbatical year. We may well quote Mr. Hunt, who says that "this difference between the teaching and engineering practice of the day is not only an indication of progress in engineering, but in some measure is an index of its rate. The student then must expect, as a normal proceeding, to supplement his graduating acquirements by practical experience, together with a personal contact with his professional brethren, in order to place himself fully abreast of the times, and to be fitted for the most effective and useful engineering service." He advises young engineers "to make use of the modern aids to information, among which are to be counted scientific societies, and a personal acquaintance with his brethren, with the innumerable hints and suggestions which come from these."

Coming now to issues more national or local in their nature we find Mr. Preece lamenting the loss of British trade, laying the blame for it in a large measure on the inefficient financial system that is rampant in England through the gross abuses of the Limited Liability Act of 1862.

He most naturally and by the use of figures, by no means startling, defends government ownership of telegraphs summing up his defence with the words, "We lead the world. There has been no failure, and there was no bad bargain," and he even goes as far as to say that "telephony is an imperial business like the post and telegraph. It ought to be in the hands of the State. The public and the press have frequently kicked violently against the present régime." Throughout his address, Mr. Preece gives great credit to American undertakings and progress, especially under the heads of electric lighting plants and power transmission, which is all absolutely to be credited to private enterprise. Our own engineering progress, however, is lauded by Mr. Hunt in the following glowing terms: "Influenced as our engineering has been by the experience and the work of other parts of the world, yet we cannot escape the fact that its development was essentially independent, and in some phases unique. Improvement has followed improvement in technical matters, profits and savings have been added to the capital invested in our industries until the continent, two hundred years ago an untraversed wilderness—one hundred years ago a struggling nation—struggling with industrial difficulties and serious political problems—has triumphed over these early limitations, and has developed into a nation which, in numbers, prosperity, and wealth takes a prominent position among the great nations of the world."

And now let us turn to each address in particular and briefly mention and discuss some of their most salient features not already referred to. Mr. Preece's address, as above stated, was mainly a review of electrical progress, particularly that of Great Britain and the British telegraph system. He speaks highly of the efficient work of the Light House Board, by which we might well profit, and advocates as a further improvement the use of wireless telegraphy.

He concludes an interesting and remarkable chapter on traction with these words: "Electric traction is invading even our streets. When the real storage battery is produced, the automobile problem will be solved. At present, steam and oil are active competitors." Very active they are, to be sure, but not very successful. Under the heading "Transmission of Power," Mr. Preece makes the significant remark that "There is but one Niagara, and we are seeing how industries are rather going to the falls than the energy of the falls is being transmitted to the industrial centres."

Mr. Hunt, after a few introductory remarks, accepts Tredgold's definition of an engineer, namely "one who is skilled in the application of the materials and forces of nature to the uses of man." He then discusses engineering practice in general, citing two typical examples, which he calls A and B, the former being an engineer of the user, and, therefore, a judge, and the latter an engineer of the maker or a counsellor. He commends laboratory development and the work of scientific societies, saying about the latter that "The greater the availability and the publicity given to the published proceedings of a scientific society, the more nearly has the society accomplished the chief object of its existence."

He says further that "It is especially desirable that English-speaking societies shall give every practicable aid to engineers using the metric system of measures, that the work of their engineers may be readily available and with the least possible trouble in making conversions of quantities from the English to the metric system." Then follow in order beautiful, interesting and inspiring chapters on "His Work, Ethics and Pleasures."

We are glad to recommend to our readers the perusal of both addresses in full and to note, underlying them both, a unanimity of ideas, sentiment, aspiration and tendencies that mark a deep unity of race, and that work, more than official treaties and alliances, for real international harmony and friendship.

The Enclosed Arc Lamp.

ONE is not apt to look upon the electrical field as among those in which the development is slow, yet when one analyzes closely the work of the last twenty years the actual number of radical departures from previous methods or apparatus is comparatively small. It has been in the details principally that progress, and valuable progress indeed, has been made. This comparative paucity of great fundamental departures, is by no means to be regarded as a sign of lack of ingenuity or of inventive ability among those engaged in the electrical arts. On the contrary it indicates, if anything, the thoroughness with which electrical inventors have, at a single glance, as it were, grasped the situation and forecast the demands completely. Take the incandescent lamp, for instance. It stands to-day in every essential feature exactly as it left the inventor's hands, nearly twenty years ago. Surely this is a record which it would be difficult to beat in any industry, and stands out all the more conspicuously when one considers the number of able men who have tried their hands at improving the incandescent lamp, and who have done not a little in that direction.

What has been remarked of the incandescent lamp might with equal truth be said of the history of arc lamps, up to within quite recent years. But during the latter period a new departure has come about, the effect of which can hardly yet be estimated. We refer to the application of the enclosing globe for the arc, which permits not only of the great increase in length of life of the carbon, but carries with it other advantages of marked value. We were personally privileged to witness the early attempts in what led finally to the successful enclosed arc lamp, and stand on record as to predictions of the ultimate success which the enclosed arc lamp was destined to reach. Our predictions have indeed been fully realized when it is seen that there are already in the neighborhood of 75,000 lamps of the enclosed type in daily use in the United States alone, and that they are being introduced rapidly abroad. The influence of the new lamp is making itself felt decidedly and it would be difficult to estimate how many incandescent or gas lamps it has displaced in interior lighting. Now that success has been achieved, one is apt to forget the earlier obstacles with which the introducers of this type of lamp had to contend. They had to overcome not only the conservatism of central station managers, who are ever reluctant to discard their existing outfits; but what was still worse, they met with the shortsighted, unfortunate enmity of labor towards all labor-saving devices. In the present case it was the trimmers who saw their occupation gone, as they thought. Indeed, so strong was the prejudice from this source that on one occasion Mr. L. B. Marks' life was actually threatened. Yet, in this case, as in many previous instances, it has turned out that the device intended to reduce the labor of attendance has actually increased the total number of hands employed owing to its introduction in large numbers in situations where it had never been used before.

Now that the enclosed arc is a demonstrated success, it is not strange that it should have become a subject for litigation. The present owners of the patents claimed to be controlling are to be commended for the course hitherto pursued by them in licensing manufacturers—one we have always urged in such cases—but it would seem that their rights are disputed in some quarters, and it looks as if the fraternity might soon be treated to another electrical cause célèbre.

Digitized by Google

ELECTRIC TRANSPORTATION

Surface Contact Electric Railways.—III.[1]

BY EDWARD H. JOHNSON.

(Concluded.)

METALLIC CIRCUIT SYSTEM WITH REVERSAL OF LEAKAGE CURRENTS.

CONSIDERABLE prejudice against the use of the tracks and the earth as a "return" conductor having been developed through the inefficient methods employed in the early days of the overhead trolley, and great stress being put upon the fact

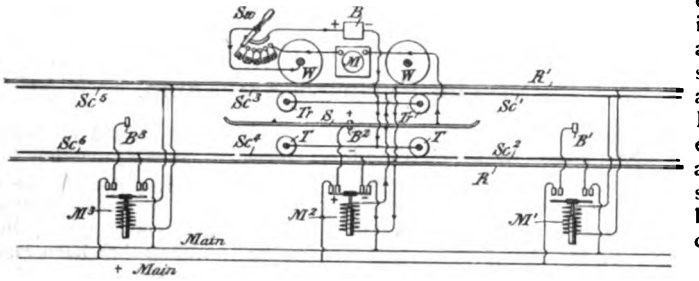


FIG. 10.

that in the open conduit system the track rails were not used as conductors, we thought it well to evolve, if possible, an alternative system in which the track rails and earth need not be employed as conductors. Our work in this direction is of an eminently practical character, not only retaining all of the good elements of the "track return" system, but involving a new feature in the line of securing safety, viz., the reversal of direction of leakage currents from that taken by the motor current in passing through the negative switch, thus guaranteeing the "opening" of the switch and consequent discharge of the current from the street surface upon the passing of the car.

To fully understand the method of accomplishing the above features, reference is being made to Figs. 10 and 11, where RR' represent the tram rails; SC^1, SC^3, SC^5, etc., one line of sectional rails SC^2, SC^4, and SC^6, another line of sectional rails, and B^1, B^2, B^3, etc., contact points for delivering the positive current, the arrangement of conductors being clearly shown in Fig. 11, which represents a cross section of the roadbed.

It will be noticed upon examination of the diagram that when the switch M', for instance, is open as shown, the positive main conductor and the negative main conductor are connected only to carbon contacts in the switch itself, there being no permanent connection between the sectional conductors or the tram rails and the negative main.

It will also be noticed that the current for energizing the electro-magnetic switches (see magnet M^2) flows from the track rails through the switch coils to one of the sectional conductors belonging to the row SC^1, SC^3, SC^5, etc.

Any leakage from the contact point B^2 would have a tendency

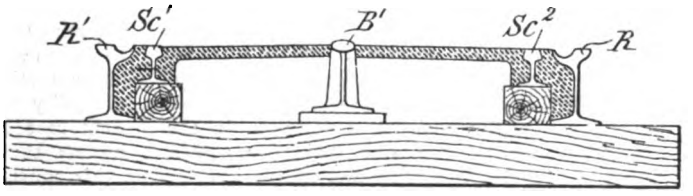


FIG. 11.

to flow from said point to sectional conductor SC^2, then through the switch coil in opposite direction, demagnetizing the same, to the track rail and to the positive sectional conductor SC^4, which is the negative service conductor, from which it will be fully understood that any leakage currents, after the car has passed, have a tendency to quickly open the electro-magnetic switch.

There has been a deal of superficial talk about the destruction of gas, water and other pipes by vagrant currents from the track rails when these are used as the return conductor. It is true that in the earlier equipments of the trolley roads too little attention was paid to securing a thoroughly good bonding of the rails, and otherwise providing for giving them a sufficient conducting capacity, and that under such conditions the electric current, seeking a pathway of lower resistance, would traverse any contiguous conducting body, thereby effecting more or less injury thereto through electrolytic action. When, however, this fact had once been made clearly manifest, additional attention was given to consolidating the rails by electric binding and otherwise, so as to give ample conducting capacity, with the natural result of so minimizing the vagrant currents as to well nigh eliminate their destructive effect; in fact, notwithstanding much that has been said of late upon this subject, it is an open question whether the evil actually exists where intelligent work has been done in laying the track rails. If, however, it is held to be desirable to have an absolute guarantee against such action, it is not at all necessary to abandon the simpler system of a single wire conductor and track return and go to the complex two-conductor system. It is quite within the electrical engineer's ability to completely eradicate the defect by the simple means of employing asphaltum about the base and sides of the rails when they are laid; the insulation thus afforded, though not of high quality, would yet be ample to care for the comparatively slight tendency of the current to leave the track rails and seek other conductive bodies.

The importance of preserving a smooth and unobstructed street surface is far greater than that of safeguarding against a wholly problematical injury to gas or water mains, but there is, I repeat, absolutely no necessity of incurring either objectionable condition. Moreover, the cost of so insulating the rails as to eliminate all leakage would be trifling in comparison with the laying of a system of double conductors.

CONCLUSION.

Having thus encountered and overcome every possible obstacle, whether raised by virtue of our own foresight, the criticism of others, or the operation of the system upon experimental trial, we determined to put it in practical operation upon a prominent New York street, and prove the complete efficacy

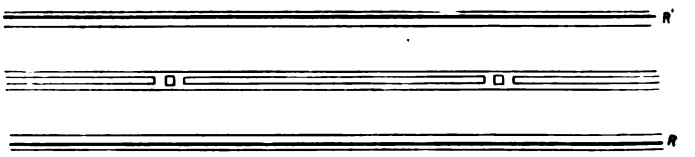


FIG. 12.

of all its factors "in the eye and under the nose" of railway managers, municipal authority and the public at large. This was done and the demonstration, continuing over a period of eight months, proved conclusively that the system was reliable, economical and safe in all weathers and all other conditions of street surface. The sole criticism—one evolved, by the way, more from a predetermined intent to condemn than upon an honest judgment—was as to the physical obstruction of the streets by the two rows of buttons then employed in the system as the contact points. This criticism had a colorable ground under the conditions with which the work was environed, which were:

First, the work was done in the winter season with frost in the ground.

Second, the buttons were founded upon the same unyielding base as the track rails, in order to keep their top surface in the same plane as the track rails. The pavement in turn was founded upon sand. The inevitable consequence was a settling of the pavement on the disappearance of frost and a consequent considerable protruding of the buttons above the street surface, thus creating an objectionable obstruction to horse and wagon traffic.

The simple remedy for this fault was, of course, to give to the street pavement as complete and satisfactory foundation as was had by the buttons themselves and as is done in cable and open conduit work; but the critics of the system were not seeking light, they were after damnatory points, and though compelled to admit the satisfactory operation of the system, its safety, etc., and even that the buttons would not be objectionable upon the street of an European city where pavements were better laid, they ad-

[1]Read before the N. Y. Elec. Society, Nov. 16, 1898, at the College of the City of New York.

Digitized by Google

hered to the conclusion that upon our streets the buttons would be condemned by municipal authority.

While still combatting this view and insisting upon the entire feasibility of so consolidating the buttons and the pavement as to maintain their surfaces always in the same plane, we have, nevertheless, in pursuance of our policy of confronting every hostile and prejudiced criticism with a complete antidote, sought and found a way and means of dispensing with the buttons altogether, substituting therefore simply a single third-rail, sectionally divided and so laid as to ensure its perpetual identity with the track rails themselves.

In accomplishing this without abandonment of any of the valuable factors incidental to the button system, Mr. Lundell has evolved an invention which may yet prove to be the "key" to the whole problem, particularly in view of the fact that it not only simplifies the system but materially reduces its cost. A description of this invention cannot now be given, as the patents are still pending, but Fig. 12 conveys an idea of the appearance of a street in which our system is installed.

An important quality of the surface contact system is its extreme flexibility—unlike the open conduit system all its operative parts are on the surface. It is, therefore, entirely feasible to pass at full speed from the surface contacts to an overhead trolley, and vice versa. There is no "plough" or other incumbrance to remove.

A storage battery may be likewise combined with the system to operate the cars over unequipped portions of a line. The battery need not be removed from the car for charging, as it is being constantly charged while passing over the equipped sections.

Opinions of Lord Kelvin and the late Dr. John Hopkinson, the one the greatest theoretical authority in the world, and the other undoubtedly the best authority on practical applications of electricity, attest and support the verbal expressions in support of the system, made by such authorities as Thomas A. Edison, Frank J. Sprague, and others. Dr. Hopkinson, in his advisory capacity as consulting engineer for English and Continental railways, strongly recommended the system to at least one of his clients, who now only awaits parliamentary action to give it a practical trial.

The railway manager who first applies this system will achieve more in the way of ridding our street of the objectionable overhead wires than have all the laws that have been enacted for this purpose.

Surface Contact Street Railroad at Monaco.

FOLLOWING closely the plans worked out by the General Electric Co. at Schenectady, the French Thomson-Houston Co. has installed and now put in operation a surface contact street railway at Monaco, France, the route extending from the city three miles to the famous gambling haunt, the Casino, at Monte Carlo. The route of this line follows closely the curving shore seen in one of our engravings. Ultimately the road will have a total length of about six miles, and form one link in a network or chain of electric roads connecting Monte Carlo and Mentone by way of Nice, giving passengers a continuous and uninterrupted view of the beautiful scenery and avoiding the tunnels of the old steam railway. A number of interesting views and details are given in a recent bulletin of the French company, and in the English "Railway World," to both of which we are indebted.

The authorities of the Principality of Monaco were anxious to secure a good traction service, but objected to the overhead trolley, and choice finally settled on the closed conduit or surface contact method, so that there is no opening or extra gutterway in any street passed through.

The track proper consists of grooved girder rail weighing about 73 pounds to the yard, cross braced by rods and spiked to wooden sleepers over which the road metal is laid to the level of the rails. The gauge is 3 feet 3 inches; 66 feet is the shortest radius, and the principal grade is that of Monte Carlo avenue, 1,320 feet long, varying in rise from 1 in 12½ to 1 in 11. The top of this hill is shown in one picture where the car stands outside the famous building in which is the bank that was broken by the man in the song. In spite of the increase in travel it is not expected that any of the more numerous passengers will succeed in breaking the bank in reality. The rails of the track are the return and are bonded.

The six cars were specially built by the J. G. Brill Company, of Philadelphia, and are mounted on Brill 21-E trucks. The truck is of metre gauge and its wheel base measures 6 feet 6 inches. The wheels are 33 inches in diameter. On each axle is mounted a Thomson-Houston motor (type G. E. 53). The cars are fitted with electro-magnetic brakes in addition to the ordinary hand brakes, and there are two sand boxes. The cars, which have accommodation for thirty-six passengers, twenty-

THE PRINCIPALITY OF MONACO.

four inside and six on each platform, have two compartments, for first and second class passengers respectively. The extreme length of the car over the dash board is 27 feet 6 inches, the platforms being 4 feet 2 inches long. The body is thus 19 feet 2 inches in length. The width of the body is 6 feet 1¾ inches at the floor sills and 6 feet 8½ inches over the posts. Each compartment accommodates twelve persons, the seats being placed transversely, those on one side of the aisle being single seats. In the first class compartment the seats are upholstered and covered with olive plush, and in the second class they are of cherry wood laths with high backs. The windows have cherry sashes and are fitted with spring roller blinds. The platforms have folding gates. The exterior of the car is painted a dark olive green with the coat of arms of the Principality in the centre of the waist panel.

Coming now to the method of operation, the plan is shown in the accompanying diagram. As will be seen, the contact

SURFACE CONTACT ROAD AND CAR, MONTE CARLO CASINO, MONACO.

studs are placed in two parallel lines within the rails, but alternately, and each row is about 10 inches from the rail nearest to it. These studs or contact pieces are of mushroom form and are not particularly conspicuous as one looks along the line. The stud is carried by an iron-threaded, cylindrical stem, which has at its lower end a copper cap into which is soldered the cable connection for the delivery of the current when contact is made by

Digitized by Google

the shoe on the car. This stud member is held in a block of wood and then completely encased in a cast-iron box. The negative or low potential series of iron boxes have an exterior base forming an integral part, and serving as an electric screen, being connected to the rails by copper cable. In placing the boxes in position they are fixed to the transverse sleepers by means of long screws passing through the exterior base. In the high potential series of studs, the boxes are unprovided with an exterior base and do not entirely fill the wooden box. They are secured interiorly to the sleepers. This series of boxes transmits the current from the cable feeders to the motors. By suppressing the exterior base of the iron box the distance is increased between the metallic part of the stud and the rail, and the loss that might be produced by leakage is diminished. The cables which are inserted in the lower part of the studs connect with commutators or automatic switches placed in chambers constructed at intervals along the line. These chambers have a depth of 6 feet 6 inches, a length of 8 feet 6½ inches, and a width of 3 feet 6 inches. They contain twenty-two switches arranged in two horizontal series, six upon each of the smaller walls, ten upon one of the larger. The fourth side is left clear, so that inspection of the apparatus may easily be made. The various apparatus is fastened to creosoted pitch pine planks secured by corner irons fastened to the walls of the pit, which is itself covered with a coating of cement. Above the free side there is a manhole covered with an iron lid, beneath which there is another cover, closed by bolts, which forms a hermetical joint, designed to prevent the entrance of water into the pit.

The switches consist of a solenoid, in which moves a bar of soft iron that actuates an iron plate. This plate armature carries

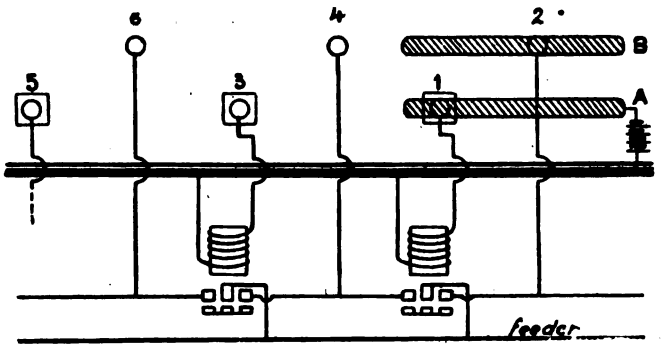


DIAGRAM OF SURFACE CONTACT ROAD CONNECTIONS, MONACO, FRANCE.

three small pieces of carbon electrically united by the plate itself. When this armature is raised these carbons coincide with three copper contacts placed under the solenoid, which are themselves insulated from each other. One of the contacts is permanently united to the principal feeder, the other two are connected respectively to the cables communicating with two successive contact studs of the high potential series, and on the other hand with contacts corresponding to the neighboring switches. As soon as the solenoid is de-magnetized the iron plate falls and the studs, which when in contact with it deliver the current at the line potential of 500 volts, naturally fall out of circuit. A magnetic blowout placed beside the switch prevents the formation of an arc when the iron plate in falling cuts off the current.

The current is taken from the studs by parallel contact bars placed underneath the cars. In this case there are two bars supported by pieces of iron fixed to the motors. A double system of levers actuated by a self-regulating spring is said to give a sufficient pressure of the shoe upon the contact stud without causing the shoe to rub along the surface of the street. The tops of the oval heads of the studs project above the surface about .55 inch.

In the diagram, the contact studs 1, 3, and 5, belong to the negative or return series, while 2, 4, and 6, are the high potential or feeder series. In order to operate the car, a small battery in the car is put in circuit with bar A, the otner pole being constantly connected to earth through the car wheel and track rails. As soon as the current traverses the bar A, the stud 1 conducts it to the solenoid electromagnet, and thus to the return circuit, which is formed by the rails in the usual manner. While the current is on, the magnet is energized and attracts and holds the plate of iron, putting it in the feeder circuit, and making connection with the studs numbered 2 and 4. The current from the main feeder thus passes through the stud 2, and by means of the iron contact bar B to the motors, the return current passing by the stud 1 and the magnet to the rails. The battery is now cut out, as the return current serves to keep the magnet energized, and so to keep the feeder circuit open while the contact bar A is over stud 1. As soon as bar A touches stud 3 the return current passes by a new circuit and traverses the coil of the second magnet. At the same moment a plate is drawn to that magnet and studs 4 and 6 are connected to the feeder. Inversely, as soon as bar A has left stud 1 that magnet is de-energized, and stud 2 is cut out of the circuit, stud 4 being still fed by the second switch. The studs are placed at intervals of 16 feet, and each chamber along the road serves to work 45 studs, extending over a length of 218 feet.

At the present time, as stated, there are six cars in operation, leaving the terminus every ten minutes, and making the trip in fifteen minutes, no casual stops being allowed, and passengers being taken up or set down at fixed points. The current at 500 volts is furnished by the Société Monegasque from a new power house not far from the Monaco Railroad station, from which it is carried by cable to the different sections of the line.

TELEPHONY AND TELEGRAPHY

A New Telephone Exchange for Brussels, Belgium.

MR. G. W. ROOSEVELT, U. S. Consul at Brussels, Belgium, reports as follows to the State Department at Washington: There has recently been erected in this city a spacious building to be devoted exclusively to the telephone service of the country, and, as now expected, it will be open to the public some time during the coming year. The building is situated in the old quarter of the city, the selection of the location being no doubt influenced by economical reasons, as the land was Government property. The construction of the building has cost very nearly $200,000, and there will be connections for 15,000 subscribers.

The building comprises a basement, ground floor, and three stories. The room devoted to the switchboard has a length of 147 feet, a width of 65 feet, and a height of 30 feet. The various stories are reached by two stairways, one of generous proportions exclusively for the public, and the other of narrow dimensions devoted to the use of the personnel of the service. When the building is entirely completed and ready for public use, each subscriber will have connection with the central by metallic circuit.

On account of the large number of overhead traction cables already existing in this city and the impossibility of a much further increase in the number or dimensions of telephone-support frames (chevalets), it has been decided to put nearly all the wires of the Brussels telephone service under ground, and in consequence cables containing two hundred wires each will be placed in underground conduits, to be distributed in the various quarters of the city. When necessity presents, one or more of these cables will be carried overhead, attached to a chevalet placed on a house top and distributed to subscribers in that locality.

The building will be heated by the system patented by Mr. L. d'Anthonay. A gas machine of 3 horse power will operate a turbine which forces cold air in the heating apparatus and drives it into the various rooms when at a proper heat and moisture. This system permits the admission of air whenever desired. It reduces to a minimum the amount of humidity and dust resulting from heating and ventilation, two causes exercising the most harmful influence upon the working of apparatus for telephonic communication. Another advantage resulting from this system of heating is the power of cooling the air in the building during the summer.

Below the massive concrete foundation, a series of iron beams has been laid. Steel shanks are attached to these rafters and connected with the iron pieces of the building in all directions in

Digitized by Google

such a manner that the entire construction is united in a Faraday cage, which thoroughly protects it against lightning. Every possible precaution has been taken to render the building fireproof. A large number of fire escapes will also be added.

Telephone Opposition in New York City.

THE recently incorporated People's Telephone Corporation, in New York City, which proposes to reduce the annual cost of unlimited city service from $240 to $100, has detailed an army of representatives to canvass the business sections of the city for subscribers. D. A. Reynolds, general superintendent of the new company, explained that the canvassing was a necessary preliminary to determine the location and limit of the field of service before actual construction could be begun. About 5,000 subscribers were obtained in the first few days, and it is expected that the number will have been increased to 40,000 by February next, when the new company intends to begin active operations. Several corporations among the subscribers obtained have also become stockholders in the new concern.

Superintendent Reynolds said that every third business man who had ordered a telephone for his office had also ordered one for his home. These home telephones, he said, it was intended to place on party lines of five and ten each, and he added that they would be supplied to business subscribers at the nominal sum of $1 a month.

Contracts for long distance lines will be signed by the new company at any time now. It was stated by the superintendent that already more than 300 independent exchanges within a radius of 100 miles of New York City had made application for connection with the concern.

Thirty exchanges will be required for the service of this entire city, and as soon as the list of contracting patrons nears completion these will be permanently located. Sample model exchanges, showing all the latest improved devices, will be opened in the offices of the company, in the Fulton Building.

One of the novel inducements extended to patrons of the new concern is to be a system of free coupons, or franks, good for use at any pay station in the service. A reduction from $90 for 600 calls is to be made to $40 for 400 calls, with additional calls as low as four cents each.

Private exchanges of five or more instruments are to have a message rate as low as two cents a call. It is proposed to supply a private line residence service for $30 a year, and a group line residence service, with unlimited service, for $12 a year. An arrangement is to be made with message service subscribers by which they will receive a share of the pay station tolls.

Private Telephone for Packing Houses.

A special dispatch from Chicago of Nov. 29, says: A company in which Armour, Swift and Nelson Morris are interested has been incorporated to build and operate an independent telegraph and telephone line to connect all their packing houses in the West with their Chicago houses. The proposed line is to connect East St. Louis. Omaha, Sioux City, St. Joseph and Kansas City. The system, it is said, is to be constructed of copper circuits on forty-foot poles, and will have five wires, so that at least five of the big packers at the yards may have a private wire for telegraph or telephone.

Penny Rate Proposed for Cablegrams.

Mr. Henniker Heaton, the English "cheap postage" parliamentarian, states that his next effort will be to establish perfect electrical communication between every part of the empire. "At present," he says, "it costs half a guinea a word to telegraph to some parts of the world, but I think that people who are in constant communication with each other are less likely to quarrel than those kept in savage isolation. You would hardly believe that out of every 110 messages received from Australia by telegraph, only one is of a social or family character, while from India there is only one out of 300. I believe that a penny-a-word electrical telegraph system would be so utilized that it would draw the peoples of the British Empire still closer together. Imperial communication never will be perfect until we can telegraph to the antipodes as cheaply as we can telegraph between London and Kent. Bear in mind this great fact, that during the last fifteen years a quarter of a million of people have annually left this country for various parts of the empire and America, and it is of the highest possible importance to make communication between these people and their friends in the old country as easy as speech, and as free as air, and thus retain their loyalty to the country of their birth."

A SEVERE FIRE broke out on Sunday night, Dec. 4, in the Rogers, Peet clothing store, on Warren street and Broadway, New York, destroying it. The flames were carried by a strong gale into the lofty Home Insurance Building, next door, and were communicated by the upper stories to the operating department of the Postal Telegraph Company, at the top of their fine building on Murray street and Broadway. Damage to the extent of about $25,000 was done in the Postal Building, and service was interrupted to a considerable extent for a short time. The total loss due to this fire is over $1,000,000.

Cooling Tower and Condenser Installation.[1]

BY J. H. VAIL.

(Member of the Society.)

THE conditions existing prior to the installation of the plant referred to in the following paper were as follows:

The electric light station was equipped with 27 boilers 48 inches in diameter, 20 feet long, with twenty-two 5-inch tubes. These boilers were set two to a furnace, grate surface 8 feet 6 inches by 5 feet, the odd boiler being set to a single furnace. The engine capacity and the load on the station already taxed all the boilers to the limit of their steaming capacity.

Plans had been prepared and estimates made for enlarging the building and increasing the boiler capacity, prior to the time the proposition was given in charge of the writer.

After a preliminary investigation of the existing conditions, the writer recommended that by the putting in of a cooling tower and a condensing system, the engine capacity of the station could be increased, leaving the boiler capacity the same, thus saving the cost of adding more boilers and enlarging the building, and at the same time obtain better economy, as well as a greater capacity for production.

To determine the steaming capacity of the boilers, two tests were made with one pair of boilers, which showed that each 48 inch by 20-foot boiler would evaporate into steam 4,281 pounds of water per hour, giving a capacity of 115,587 pounds steam per hour with every boiler in operation. Coincident with the boiler test, one 18½ by 30 Buckeye engine was using the steam from the boilers under test. Indicator cards were taken at fifteen minute intervals for five hours. The result from the engine test and average of all cards showed a steam consumption of 46.8 pounds steam per indicated horse power per hour.

After the data derived from these tests had been analyzed, the writer recommended that the Buckeye engine should be converted from the 18½ by 30 high pressure engine into a 14¼ and 25 by 30 tandem compound condensing engine. Also that an additional 750 horse power tandem compound condensing engine should be erected in the station, together with a cooling tower and the necessary condenser equipment, and that the only change in boilers should be to raise the working pressure. No increase of boiler capacity has been made.

After investigation, the Barnard type of cooling tower was selected as desirable to best meet the conditions existing at this plant, which were, minimum floor space, and minimum weight, and a considerable elevation above floor level of engine room.

DETAILS OF COOLING TOWER.

The cooling tower is of the twin type, having two chambers, with a pair of fans supplying a strong draft of air to each chamber. The interior dimensions are 12 feet 3 inches by 18 feet by 29 feet 6 inches high. The tower is mounted on a sub-structure of steel columns and I beams, supported on substantial foundations. There are outside galleries and ladders affording convenient access to necessary points. The shell of the tower

[1]Abstract of paper read at the nineteenth annual meeting of the A. S. M. E., New York, Dec., 1898.

Digitized by Google

is of steel, 3-16 by ¼ inch plates, properly reinforced with angle and channel irons.

The hot water from the condenser discharge is delivered through a 10-inch wrought-iron pipe, extending the whole length of each chamber, slotted on top, and perforated at the bottom, giving equal distribution to a series of 96 distributing pipes, extending across the tower, each pipe being slotted and perforated, thus insuring a very uniform distribution of water.

Means are provided for cleaning these pipes, which is found very necessary in cold weather, when the cylinder oil from the exhaust steam is liable to clog the pipes and interfere with uniform and free distribution of the water.

The hot water falls from the distributing pipes over 42 galvanized wire mats, made of No. 19 steel wire, woven to No. 5 mesh. Each mat is 12 feet by 15 feet 6 inches, affording a total of 8,064 square feet of cooling surface.

Each mat is suspended by galvanized iron hooks, and is easily removed for cleaning or repairs.

In actual service it is found that the water is uniformly distributed.

The circulation of air is furnished by two pairs of 8-feet diameter fans, each pair of fans being mounted right and left on a 2 15-16 diameter shaft, and the four fans being capable of delivering 360,000 cubic feet of air per minute when driven at a speed of 150 revolutions per minute.

The air entering the tower chambers at the lower section is deflected vertically from each fan, thus avoiding cross currents, and affording a uniform blast through and between the mats.

The rated capacity of each section of this cooling tower is to cool the circulating water needed to condense 12,500 pounds of exhaust steam, from an initial temperature of 132 degrees Fahr. to 80 degrees Fahr. when the atmospheric temperature does not exceed 75 degrees Fahr., nor the humidity 85 per cent.

On account of suitable floor space for the cooling tower not being available near the ground level, it became necessary to mount it on a sub-structure above the boiler room, the total elevation from the condenser to the discharge opening at top of tower is 58 feet.

Total weight of cooling tower, including water in transit, 86,000 pounds. This places more duty on the circulating pump than is desirable, but is unavoidable, for the reasons stated.

The circulating water is handled by a Blake vertical twin air pump and jet condenser.

In an equipment of this kind it is very important to have facilities for driving the fans at variable speeds; this requisite flexibility has been obtained by using a small vertical engine, direct connected to the shaft of each pair of fans.

The first intention was to drive the fans belted from electric motors. An analysis of all the conditions proved this method undesirable for the reason that there would be too many translating devices interposed between the live steam pipe and the shaft of the fan.

The following table, extracted from the log records for many months, shows details as to temperatures, speed of fans, reduction of temperature of condenser discharged, etc.

	—1898—					
	Jan.31.	Feb.	June20.	July.	Aug.26.	Nov.4
Time	9 p.m.	8 p.m.	8 p.m.	8 p.m.	8 p.m.	5.35
Temperature atmosphere	30°	36°	78°	96°	85°	59°
Temperature condenser discharge to cooling tower	110°	110°	120°	130°	118°	129°
Temperature condenser suction returned from tower to tank.	65°	84°	84°	93°	88°	92°
Degrees of heat extracted through tower	45°	26°	36°	37°	30°	37°
Speed of fans at tower, r.p.m.	36	0	145	162	150	148
Vacuum at condenser	25½	26	25	24½	25½	25
Strokes of condenser pump	30	30	37	44	43	28
Lbs. boiler pressure	110	110	120	120	120	112
Temperature boiler feed	212°	212°	210°	211°	213°	213°

As previously noted, the 18½ by 30 Buckeye engine was changed to a 14¼ and 25 by 30 tandem compound condensing engine by bolting new tandem cylinders on the existing frame and making necessary alterations in valve rods, etc.

This change in an existing engine clearly illustrates the advantage derived from the condensing system. This engine was fitted with a receiver and reheater between high and low-pressure cylinders; several tests have been made and representative cards were analyzed to determine whether the reheater is of value, and as a result of these tests we have found that the reheater condensation amounts to 63 pounds of steam for each horse power gained in the low-pressure cylinder. We therefore abandoned it as an expensive luxury. We are not now discussing the value of reheaters, and for this reason I simply give the facts without entering into details.

There are two feed-water heaters in connection with the condensing plant. First, an intermediate tubular heater in the line of exhaust between low-pressure cylinders and condenser. Second, an auxiliary feed-water heater was also attached, receiving the exhaust from the condenser and boiler feed pumps, and any other auxiliaries.

The feed water is first heated in a tank that receives the exhaust from the general line of high-pressure engines. The feed water then passes through the intermediate heater, and thence through the auxiliary heater and reaches the boiler at a temperature upwards of 200 degrees Fahr.

The pressure of other important work has prevented the writer from making accurate tests to determine the exact economy derived from the condensing plant, and while awaiting the opportunity to make such tests, we have the satisfaction of having increased the station capacity about 1,000 horse power with the aid of a condensing system, using the same water in continuous circulation, and also that the boiler plant previously stated to be fully loaded supplies steam for this additional work with boilers to spare.

Russell & Co 's Engines, Massillon, O.

THE Russell automatic engine as found in street railway and electric lighting plants and in farming machinery has dotted the map of the United States all over thickly. A specialty is made of compound engines, both portable and stationary, together with tubular boilers for all purposes. The stationary engines designed for street railway and electric lighting purposes are built in different sizes up to 1,000 horse power and are usually of the four-valve type. Some of the special features include the steam valve mechanism in which a double slide valve is employed, two rolling exhaust valves, the cut-off valve being outside the main valve and sliding upon its face. The first or main valve has a uniform travel with wide ports and is driven directly from an eccentric on the main shaft, while the cut-off is triple ported and the travel is limited by the governing mechanism in such a manner that a very sensitive speed regulation is secured with a large degree of steam economy. Both single and four-valve engines are built. In the machines having a stroke above 20 inches, four valves are usually employed. Both the Rites and Giddings type of governors are employed. Not only the general features of these machines as related to strength and economy recommend them, but the particular features of workmanship and finish which characterize all the output of these extensive works insure long life and satisfactory service. All these features which bear weight with prospective purchasers could not be secured, however, were it not for the ample and complete tool equipment of the shops. The buildings as shown in the accompanying illustration are located on a tract of twenty acres near the city. The walls of these are all of brick, and the relation and arrangement is clearly shown in the illustration. The different departments and buildings are known by letter and number among the employees, and systematic methods characterize the movement of the material through the different departments; the work on the stationary engines being kept distinct from that on the road and thrashing machines. The special feature of the shop equipment most worthy of note is the almost universal application of compressed air for operating the hoists and cranes, pneumatic hoists and presses being found everywhere, even to the operating of the letter presses in the offices. So prevalent are these appliances that the remark of one of the officers that "we have air to sell" is almost literal. The air pressure is obtained from two single stage compressors, one of the Clayton and the other of the Knowles type, and a pressure of sixty pounds is maintained in the storage tanks. The energy is distributed about the work through nearly 3,000 feet of underground pipes and is available in all parts of the building. The mechanism for utilizing the air power in the operation of the lifts, trolley hoists and cranes is all of original design and was manufactured in the works. This company claims to have been the first to employ compressed air in works of this description having installed an air plant in 1885.

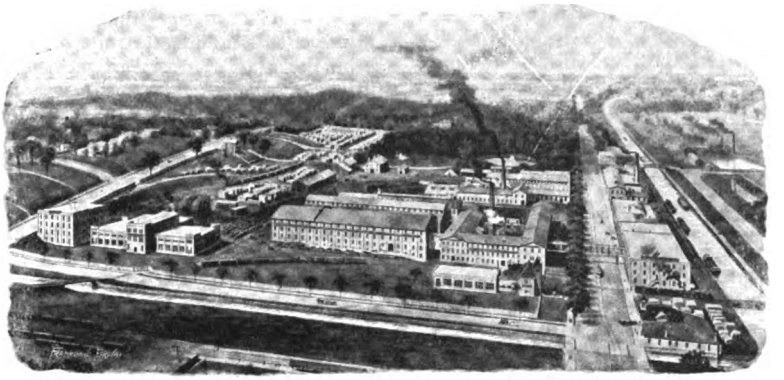
The pneumatic appliances, however, do not include all the lifting and shifting equipment. There are a number of traveling cranes of the Morgan type which are operated by square shafts supported by disappearing bearings. One of them, that in the erecting shop, has a shaft 300 feet in length with a correspond-

Digitized by Google

ing travel for the crane. There are also two traveling electric cranes, that in the foundry being of the Shaw type. Electricity is also employed for operating the blast fan in the foundry department through the medium of a 50-h. p. Westinghouse motor. Besides the original appliances, a number of commercial pneumatic tools are employed, including Haesler air chipping tools and portable thread cutters for threading the stay bolt holes in boiler fire boxes.

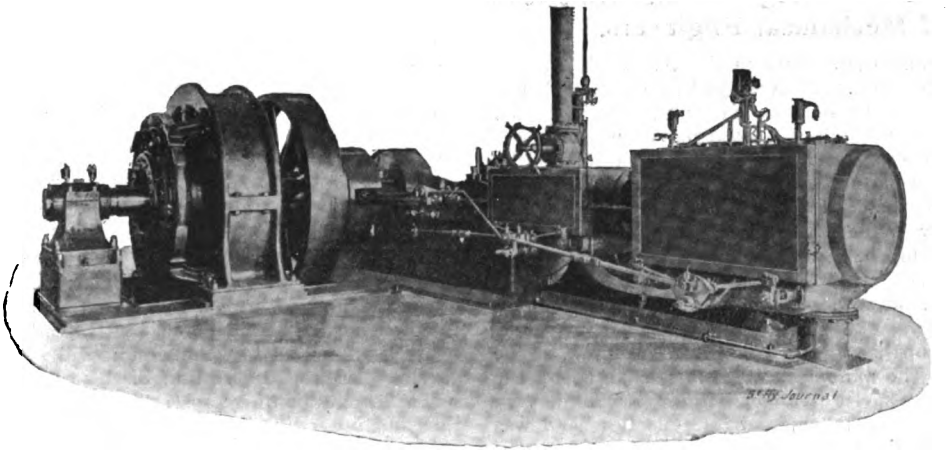
The small tool department is not less interesting than the machine tools and appliances and is a striking illustration of the system and order that prevails throughout the establishment. The tool department occupies the end of the main floor of the machine shop near the superintendent's office, and is divided into five sections by wire screen partitions. Here the twist drills and cutting tools of every description are made, repaired and stored, suitable racks being provided on which the tools are classified and kept. This department is in charge of an attendant whose duty it is to deal out the tools as they are called for by the machinists who deposit a personal metallic check which is put into the receptacle from which the tool is taken. By this means a complete record of each tool is kept and any loss or breakage can be traced by the check to the individual responsible for it. The machine oil is also dealt out by the same attendant and a record of the amount dealt out to each individual is kept. The oil is stored in an underground tank in the yard, near the tool room and is forced through the faucets by air compression. The shop drawings of detail parts are also kept in this department and are dealt out in about the same manner as the tools. Revolving racks or cabinets are provided with numbers and hooks on which the checks are placed. Special attention is given to the preparation and preservation of all the blue prints and these are uniform in size and pasted on stiff board. On these the parts are properly lettered and numbered so that any piece of any engine that may be sent out can be duplicated at any subsequent time. These drawings also assist the superintendent or foreman in checking the parts of all orders when shipments are to be made.

The power for operating the shafting throughout is derived from a 350-h. p. Russell tandem compound engine, having cylinders 16 by 24 by 24 inches, and running at 148 revolutions. The power is transmitted to the main shaft by continuous rope belts with tension sheave adjustment. There is also a small engine for operating one of the compressors and heating fans for the erecting shop. Tubular boilers furnish the steam, and these also are of the company's own make. The heaviest iron working tools are found in B.-2 shop and consist of planers and large lathes, one being an unusually large turret headed lathe. One planer is sufficiently large for stock six feet square. There is also a large open side planer. The other tools are too numerous to mention in detail. One notes in passing through the works an air of neatness everywhere, the floors which are of brick, being kept scrupulously clean. As an aid in this direction metal waste buckets are provided at suitable points into which all dirty waste and litter are placed. The shops throughout are carefully inspected each month to see if the regulations in regard to cleanliness are carried out.



RUSSELL & CO.'S ENGINE FACTORY, MASSILLON, OHIO.

Among the special appliances may be noted a pneumatic testing press in which a test is made of metal from each charge of the foundry cupolas, test bars being cast at intervals through pouring. These bars are one inch square and twenty-four inches in length and are chilled at each end. The testing press is provided with a deflection gauge and a gauge to indicate the pounds pressure. The bar is placed in a horizontal position and the pressure is applied at the under side in the middle of the bar. A test made for our information of a bar of the above character showed a deflection of 7⅙ of an inch and broke under a strain of 1,250 pounds. The material is also subjected to a further test by drilling and an inspection of the character of the metal from the chips. Provision against fire is made by the establishment of two hose houses at suitable places in the yard fully equipped and in connection with which there is a fire alarm signal by means of which the whistle is blown from push buttons located at different points about the works. The employees are organized into two hose companies and there is a fire drill at suitable intervals. The water under a pressure of forty pounds per square inch is derived from a standpipe located on a rise of ground back of the



RUSSELL AUTOMATIC ENGINE DIRECT CONNECTED TO A GENERATOR.

Digitized by Google

shops, into which the water is pumped. From the same source power is derived for operating a hydraulic lift or elevator on which the material for charging the cupolas is elevated. The relation of the different buildings is shown in the accompanying illustration. The dimensions are as follows: Machine shop, which is built in the form of a hollow square with the engine room located in the open space is 239 feet front. The warehouse is 336 by 65 feet, the boiler shop 320 by 80, blacksmith and forging foundry 225 by 100, erecting shop 185 by 70, and casting and cleaning room 185 by 45, and the office with stock room adjoining, is 60 by 100, and another storeroom 100 by 90 feet in the rear of the foundry. On the opposite side of the street from the works proper is a large brick building 400 by 100 feet, which is used as a store house for the farm engines and thrashing and road rollers. Nearby is still another brick building which answers for the power station for the street railway and electric light plants of the city. This station is equipped with Russell machinery and is owned and operated by the company who furnish power for the street railway and lighting companies. The power equipment of this station consists of four tubular boilers of 125 horse power each, three tandem compound condensing engines with cylinders 15 by 24 by 24 rated at 350 horse power each. The engines are provided with an automatic oiling device and transmit their power by means of continuous rope belts to a countershaft from whch the power and lighting generators are driven. In the operation of the station careful records are kept, the coal and ashes being weighed, together with data of feed water temperature, draft and pressure records. Note is also made as to when each engine is put in service and the number of hours in which it is running each day, from which records the cost of each day's run is easily computed. Sidings from the steam railway lines lead into and about the yard and the freight cars are shifted by means of one of the road traction engines which are manufactured by the company. The company manufacture about three hundred and fifty compound farm engines per year and about one hundred and fifty simple, besides steam road rollers up to 15 tons weight. They are also extensive manufacturers of thrashing machines with pneumatic stackers.

The Russell Company was originally organized in 1842, and has included in its organization the six Russell brothers, three of whom still survive.

SOCIETY & CLUB NOTES

Nineteenth Annual Meeting of the American Society of Mechanical Engineers.

THE nineteenth annual convention of the A. S. M. E. was held at the society's home, 12 West 31st street, New York, from Nov. 29 to Dec. 2, and was attended by an unprecedented number of members and visitors, over 500 names having been registered. Not only in size but also in its composition was the attendance a remarkable and encouraging one, for there were present a large number of electrical, civil and mining engineers, who were undoubtedly induced to attend the convention on account of the relationship between the various branches of engineering which becomes closer year by year, as well as the great variety and practical value of the papers read and topics discussed.

The convention was opened at 9 p. m. Tuesday evening, at the society's parlors, when the annual address was delivered by the retiring president, Mr. Charles Wallace Hunt. It was a very scholarly address, presenting much food for reflection, and was received with a great deal of enthusiasm by his hearers. It is referred to editorially this week in our columns. After listening to the address the members enjoyed a light luncheon, which was followed by a smoker.

At the Wednesday session the report of the Council was read, which included a letter from the Inst. of Civil Engineers of Great Britain, inviting members of the A. S. M. E. who may be in England during their trip to the Paris Exposition in 1900, to be the guests of the Institution. The Council reported a total membership of 1,881. An amendment to the constitution was adopted, which opens the doors of the society to foreigners.

The committee's report on the Revision of the 1885 Code, relative to a standard method of conducting steam boiler trials, was submitted and ordered printed in convenient pocket form. As Mr. Kent remarked, the code, as it now stands, and as it will be printed, giving all values in metric as well as English measures, will be accepted by other nations and thus practically become an international code.

Prof. Jacobus read the report of the committee on steam engine tests which was very complete and compiled with the utmost care. It was also ordered printed and to be distributed among the members. Final action on it will not be taken until the society meets again, at Cincinnati, Ohio.

Mr. Kent then addressed the meeting on the necessity of keeping up the high standard of the society's transactions, and only printing such papers as will be of value to the engineering profession and contain no incorrect or misleading data. He also pointed out the necessity of printing the discussion together with the paper, as the former is often of equal or greater importance than the latter.

Before proceeding to the reading of the papers, the society honored Commodore George W. Melville, Chief Engineer of the U. S. Navy, as well as that gallant branch of our service which he represents, by electing that well-known and highly esteemed engineer to the office of president for the coming year. Commodore Melville, having been escorted to the chair, made a brief response to Mr. Hunt's remarks, in which he thanked the society for the honor they had conferred on him and assuring them of his keen realization of the grave responsibilities of this high office.

The vice presidents newly chosen are John C. Kafer, of New York; Charles M. Jarvis, of Berlin, Conn.; Walter S. Russell, of Detroit, Mich.; E. D. Meier, of St. Louis; George R. Stetson, of New Bedford, Mass., and B. H. Warren, of Pittsburg. The managers are H. S. Haines, Paris; Gus. C. Henning, New York; A. W. Robinson, Milwaukee; James B. Stanwood, Cincinnati; H. H. Suplee, New York City; George Richmond, New York; E. C. Felton, Harrisburg; R. H. Soule, Chicago; A. M. Goodale, Waltham, Mass. William H. Wiley was elected treasurer and F. R. Hutton secretary.

The following papers were then read and discussed: "Notes on Strength of Wheel Rims," by A. K. Mansfield; "The Bursting of Small Cast-iron Fly Wheels," by C. H. Benjamin; "Cooling Tower and Condenser Installation," by J. H. Vail (abstracted on page 567).

During the afternoon the members went sightseeing, visiting among other places the Duane street Edison station, where they were welcomed by the officers and engineers of the company. In the evening a reception and conversazione was held at Sherry's, which was attended by about 500 members, and their ladies and friends. Dancing was indulged in during the evening, and supper served continuously between 10 and 12 o'clock.

At the Thursday morning session, the following papers were read: "Theory of the Moment of Inertia," by C. V. Kerr; "Improvements in Steam Boilers," by W. C. Le Van; "Generation and Utilization of Steam by the Lykens Valley Coal Company," by R. Van A. Norris; "Valve Gear of the Willans Engine," by John A. F. Svenson; "Methods of Testing Indicators," by I. S. Jacobus; "Variation of Belt Tensions with Power Transmitted," by W. S. Aldrich. The following topics were discussed: "What constitutes a seamless tube?" and "On how small a tool does it pay to put an electric motor?"

In the afternoon a visit was paid to the Astor Place branch of the post office, to inspect the intermediate station receiving and transfer apparatus, invented by B. C. Batchelder, which has lately been installed in connection with the pneumatic tube mail service. A brief description of this apparatus, as given by the inventor, may be of interest: "The main line tubes pass through this and other stations, and as the carriers must all be of the same size, the difficulty of devising an apparatus which would assort them mechanically, and at the same time without error, was not easily overcome, but the mechanism in use has proven satisfactory. The intermediate apparatus consists of a machine resembling a large wheel with a wide flange. A carrier running at the rate of forty miles an hour enters the section of tube within the wheel, strikes the air-cushion, and comes to a rest without shock. The diameter of a small metal disc on the end of the carrier determines whether or not it will be discharged at the station in which the machine is located. If the disc is wide enough to span the joints of two needles in the bottom of the

Digitized by Google

receiving tube, an electric connection is established, the wheel revolves forty-five degrees, and the carrier is discharged through a sliding valve into the station-receiver. If the carrier belongs to a station further along the line, the wheel of the intermediate apparatus turns ninety degrees, and drops it into the main-line tube, and away it goes on its journey. Should two carriers arrive at the receiving machine within, say, three seconds of each other, the second carrier is held back automatically until the apparatus has despatched the first carrier at its proper headway, which, on the Station H line, is eighteen seconds.

Thursday evening was left free for theatre parties or social opportunities, and many members gathered at the society's home, while a great many were to be found at the Engineers' Club, where a reception was held and a lantern talk was given by Mr. Humbert on "Hunting Big Game in Africa."

At the Friday morning closing session, the following papers were read: "Calorific Power of Weathered Coals," by R. S. Hale; "Mechanical Plant of a Modern Commercial Building," by W. H. Bryan (abstracted on page 560); "Specific Heat of Superheated Steam," and "Experiments on the Flow of Steam Through Pipes," by R. C. Carpenter. The following topics were discussed: "Have you any new notions on machine shop floors?" and "Is it of real advantage to submerge the smoke-box of an upright boiler to prevent expansion of the tubes?"

After attending to the concluding business, the society adjourned sine die, to meet again in the spring at Cincinnati, Ohio.

Missouri Independent Telephone Association.

A special dispatch from Columbia, Mo., of Nov. 23, says: The opposition telephone exchange proprietors have organized the Missouri Independent Telephone Association. Thirty exchanges were represented at their first meeting. J. A. Hudson, of Columbia, was chosen temporary chairman, and E. W. Henry, of Glasgow, was made temporary secretary. A committee, consisting of the chairman and secretary and Theodore Gary, of Macon; E. D. Graham, of Mexico, and D. F. Vincent, of Slater, was appointed to report a form of constitution and by-laws at the next meeting, to be held in St. Louis December 27.

Exports of Electrical Material from New York.

The following exports of electrical material are from the port of New York for the week ending Nov. 15: Argentine Republic—94 packages electrical material, $4,105; 16 packages electrical machinery, $1,319. Antwerp—53 cases electrical material, $2,149. British West Indies—30 packages electrical material, $568. British Australia, 93 packages electrical material, $7,719. Berlin, 17 packages electrical material, 789. Cuba—433 packages electrical material, $1,591. Central America—9 cases electrical material, $430. Christiania—4 cases electrical material, $300. Copenhagen—4 cases electrical material, $83. Ecuador—8 cases electrical material, $295. Glasgow—15 cases electrical plates, $300; 7 cases electrical material, $462. Genoa—10 cases electrical machinery, $350; 1 case electrical material, $111. Hamburg—30 packages electrical material, $6,458. Havre—53 cases electrical machinery, $3,162. London—64 cases electrical machinery, $6,560; 52 cases electrical material, $13,208; 1 case electros, $17. Liverpool—89 cases electrical material, $4,051; 26 cases electrical machinery, $273. Mexico—35 packages electrical material, $1,354. Marseilles—55 cases electrical material, $2,525. Manchester—6 cases electrical material, $660. Naples—109 cases electrical machinery, $17,746. Odessa—1 case electrical material, $200. Puerto Rico—1 case electros, $10. Peru—12 packages electrical material, $316. Southampton—1 case electrical material, $50. Santo Domingo—76 packages electrical material, $2,451. U. S. of Colombia—7 packages electrical material, 88. Venezuela—5 cases electrical machinery, $231. Wigan—1 case electro shells, $300. Waterford—1 case electrical material, $50.

The following exports of electrical material are from the port of New York for the week ending Nov. 22; Antwerp—20 cases electrical material, $2,097. British East Indies—14 packages electrical material, $400. British Australia—28 cases electrical material, $1,355. Berlin—4 packages electric machinery, $872; 2 cases electrical material, $50. Brazil—179 cases electrical material, $5,258. Bremen—5 cases electrical material, $375. Brussels—3 cases electrical material, $65. British West Indies—71 cases electrical material, $3,004. Cuba—18 cases electrical material, $703. Central America—1,632 packages electrical material, $3,934. Frankfort—1 case electros, $10. Hamburg—11 packages electrical material, $2,262; 56 packages electrical material, $2,867. Hayti—3 cases electrical material, $33. Havre—106 cases electrical material, $17,877; 68 cases electrical material, $3,852. Liverpool—18 packages electrical material, $1,253; 70 packages electrical machinery, $3,389. London—115 packages electrical material, $3,540; 150 cases electrical machinery, $38,293. Leeds—6 cases electrical material, $221. Mexico—2 cases electrical machinery, $167. Marseilles—14 packages electrical material, $1,500. Munich—2 cases electrical material, $29. Nova Scotia—2 cases electrical material, $22. Naples—82 cases electrical machinery, $3,050. New Zealand—24 cases electrical material, $592. Newfoundland—3 packages electrical material, $38. Newcastle—29 packages electrical machinery, $3,000.

American Steam Engines Wanted in France.

Consul Jackson writes from La Rochelle, November 9, 1898: "There is an opening in this consular district for several steam engines and boilers of American make. The engines must be 35 horse power, and the boilers must be capable of supplying these engines. The prices, including cost of transportation, etc., to this district or Tonnay-Charente, should not exceed those asked here (about $2,000). Correspondence, with specifications and prices, should be addressed to Mr. Grenfel Stewart, 13 Rue du Palais, La Rochelle, France."

The Hum of the Horseless.

A sound comparatively new in the streets, says the New York "Sun," is the hum of the electric carriage. The passing of one of these vehicles still attracts some attention, even on Broadway, but it is in the residence streets, where the noise of the traffic is less, that the sound of them is most striking. Take, for instance, a street that has been laid with asphalt pavement. There is no longer heard in this street the rumble or rattle of wheels over the paving stones. There is heard only the sound of the horses' hoofs, and that is a clamping, in regular time, that is over the paving stones. There is heard now only the sound of the electric cab going through the block. No hoofs and no rattle of the wheels on the stones, but the curious machine-like hum of the vehicle as it moves, something intensely modern and up-to-date and characteristic of the moment.

Electrical Undertakings in Our Colonies.

After the war which has left us in the possession of several colonies it is but natural that we should take an inventory of their electrical development. In doing this we find that there are 2,300 miles of telegraph lines with 153 offices in Cuba. Also the principal towns of Cuba are lighted by electricity, and the greater number of the sugar estates also. In Puerto Rico there are 475 miles of telegraph lines. Motors imported into Puerto Rico are subject to a duty of $2.31 per 100 kilogrammes. Honolulu, of 30,000 inhabitants, is lighted with electricity, and has a complete telephone service. The islands Dahu, Kania and Hawaii have telephones to every point. Manila is lighted with electricity, and has a complete telephone system. In the Philippine Islands there are 720 miles of telegraph lines, and these are admitted free of duty, but motors are subject to a duty of 51 cents per 100 kilogrammes.

Lighting Consolidation in Montreal.

A special dispatch from Montreal, Can., of Nov. 29, says: A scheme is on foot for the consolidation of the Montreal Gas Company and the Royal Electric Company, which may be ultimately extended to the other lighting companies. The capital of the gas company is $3,000,000, and that of the Royal Electric $1,500,000, and it is proposed to form a new company to take over the businesses with a capital of $10,000,000, which would, it is claimed, amply provide for the present businesses and improvements contemplated. The earnings of the gas company are about $350,000, and of Royal Electric $213,000. Gas pays

Digitized by Google

10 per cent. and Royal Electric 8 per cent. in quarterly dividends. A meeting of leading capitalists has been held to perfect the scheme.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued Nov. 22, 1898.

Batteries, Primary:—

GALVANIC BATTERY. Charles T. Richmond, Cleveland, O., assignor to the National Carbon Co., Cleveland, O., 614,759. Filed July 18, 1898. Of the Le Clanche type; details of construction.

Batteries, Secondary:—

SECONDARY BATTERY. Nathan H. Edgerton, Philadelphia, Pa., 614,539. Filed Sept. 14, 1897. Embodies a series of superposed plates, each consisting of a zinc element, a coating of lead applied thereto, the lead having a layer of red lead superimposed thereupon, and granulated non-conducting charcoal supported upon the red lead.

Conductors, Conduits and Insulators:—

METHOD OF MANUFACTURING ELECTRIC CABLES. Sebastian Ziani de Ferranti, Hollinwood, England, 614,453. Filed Dec. 28, 1897. Consists in first forming a circular stranded conductor, compressing the conductor to the shape of a part of a circle in cross-section, insulating the conductor, and lastly laying a number of such conductors, together forming an approximately cylindrical cable.

Dynamos and Motors:

COMMUTATOR. John R. Grindrod, Lynn, Mass., assignor to the General Electric Co., New York, N. Y., 614,462. Filed Feb. 6, 1897. A railway motor commutator which can be properly machined and sent as a whole to the user without an internal shell and clamping rings and in such shape that it can be mounted on the old shell and connected to the winding without machinery.

DYNAMO-ELECTRIC MACHINE OR ELECTROMOTOR. Eugene Cantono, Pavia, Italy, 614,608. Filed Dec. 16, 1898. The fixed and rotative members of its magnetic field are movable toward or from each other to vary the air space, and with an elastic medium tending to widen the air space, combined with means for controlling the field excitation.

Electro-Metallurgy:—

METHOD OF AND APPARATUS FOR TREATING ORES. Joseph G. McNulty, New York, N. Y., 614,572. Filed May 7, 1898. Consists in mixing pulverized ore with an electrolytic fluid, causing the mixture to flow from one level to another between adjacent electrode plates of opposite polarity, passing an electric current between the plates and vibrating the electrodes in a direction substantially at right angles to the plane of the electrodes for the purpose of preventing the polarization thereof.

Lamps and Appurtenances:—

HANGER FOR ELECTRIC LAMPS. Junius E. Mayo, Belvidere, Ill., 614,484. Filed June 16, 1898. A hanger for arc lamps, combining a circular vertical socket opening downward, a spring on the socket normally closing a circuit, a stud fast to the spring and projecting inward, through a transverse opening, in the socket, into the vertical opening therein, and a stem adapted to enter the socket and, by outward pressure upon the stud, open the circuit.

Miscellaneous:—

TRANSFORMER STAMPING. Dugald Caleb Jackson, Madison, Wis., and William Benjamin Jackson, Grand Rapids, Mich., assignors of one-half to William D. Packard and James W. Packard, Warren, O., 614,474. Filed Sept. 27, 1897. A transformer core built up of strips of sheet metal, some of the strips being folded on themselves, and some not folded.

OZONIZING APPARATUS. Alexander S. Ramage, Cleveland, O., assignor to Joseph Black, Cleveland, O., 614,500. Filed Jan. 23, 1896. Details for construction.

ELECTRIC LIGHTING GAS BURNER. John M. Anck, Philadelphia, Pa., 614,528. Filed Oct. 19, 1897. A fixed electrode, a valve stem, a plate mounted on the stem, a lever also mounted thereon, insulation interposed between the plate and lever and between the lever and stem, an electrode carried by the lever, a lever pivoted to the plate, and means for moving the pivoted lever into contact with the first mentioned lever.

TRANSFORMER SYSTEM AND APPARATUS. Adolph Müller, Hagen, Germany, 614,571. Filed July 30, 1897. More particularly designed for that class in which the transformation is effected by means of storage battery systems.

ELECTROLYTIC APPARATUS. Friedrich A. Thum, Newark, N. J., 614,633. Filed Feb. 8, 1898. An element of an electrolytic series plant, consisting of a non-conducting frame adapted to hold the material to be treated, the frame being closed at one side by a removable plate of conducting material, and at the opposite side by a non-conducting foraminous material, such as muslin.

CONSECUTIVE VIEW APPARATUS. Harry Norton Marvin, New York, N. Y., assignor to the American Mutoscope Co., New York, N. Y., 614,738. Filed April 21, 1897. Means for illuminating the views as they pass into the field of view of the apparatus and for cutting off the light automatically as soon as the operation of the apparatus ceases.

Railways and Appliances:—

CONDUIT AND ELECTRIC CURRENT CONDUCTOR FOR SURFACE RAILWAYS. Arthur Petzenbürger, Gross Lichterfelde, Germany, 614,575. Filed March 30, 1896. Details of construction.

MEANS FOR DRIVING RAILWAY, TRAMWAY OR AUTOMOBILE CARS. Gustave Dupont and Maxime Johannet, Paris, France, 614,709. Filed Oct. 29, 1896. Combines a front and rear axle of two counter shafts, a field magnet and armature mounted on each, a main shaft geared to both counter shafts, a reversible clutch on the main shaft and a single circuit including the armature of both dynamos.

Switches, Cut-Outs, Etc.:—

POTENTIAL SWITCH. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Bros. & Co., New York, N. Y., 614,472. Filed Aug. 5, 1897. The coils are included in the main circuit and in a shunt circuit, respectively, and wound in opposition and have an adjustable core-piece.

MAGNETIC CUT-OUT. Leonard Andrews, Hastings, England, 614,686. Filed Nov. 29, 1897. Consists of a core surrounded by a continuous winding in series with the generator, a shunt winding part of which is in the same direction as the series winding and the other part in the reverse direction and a switch controlled by the core.

CIRCUIT BREAKER. William I. Crawford, St. Louis, Mo., assignor of one-half to Abraham Cook, St. Louis, Mo., 614,794. Filed Aug. 23, 1897. Comprises an armature, a vertical stem whereby the armature is suspended, a standard to which the stem of the armature is secured, so as to swing from its upper end, and an adjustable clamp for connecting the stem of the armature to the standard between the head of the armature and the point where it is secured to the standard.

Telephones:—

SWITCHBOARD APPARATUS, SIGNAL AND CIRCUIT. Thomas C. Wales, Jr., and Frederick L. Rhodes, Winchester, Mass., assignors to the American Bell Telephone Co., Boston, Mass., 614,677. Filed Nov. 26, 1897. Details of construction.

Classified Digest of U. S. Electrical Patents Issued Nov. 29, 1898.

Alarms and Signals:—

REPEATER. Winthrop M. Chapman, Needham, Mass., 615,014. Filed March 17, 1898. Adapted for fire alarm circuits. Details of construction.

ELECTRO-MECHANICAL STRIKING MECHANISM. Clarence E. Beach and Herman W. Doughty, Binghamton, N. Y., assignors to the Star Electric Co., New York, 615,057. Filed Sept. 8, 1896. Consists of magnets, an armature influenced thereby, a notch moving with the armature, an actuating wheel engaging with the notch and an arm operated by the actuating wheel and arranged to operate the armature.

SIGNALING. John Pressley Coleman, Edgewood Park, Pa., assignor to the Union Switch and Signal Co., Swissvale, Pa., 615,142. Filed Jan. 3, 1898. Consists in a construction of mechanism whereby under abnormal conditions the signal-shifting mechanism becomes operative to pull the signal to danger position.

Batteries, Primary:—

PRIMARY BATTERY. Henry K. Hess, Philadelphia, Pa., 615,172. Filed Feb. 2, 1898. Comprises a series of partitions formed of frames of conducting metal acting as one terminal of the battery and supporting sheets of porous material, the partitions forming chambers, the alternate chambers being for the reception of the depolarizing agent, the other chambers being for the reception of the exciting fluid and zinc electrodes.

Conductors, Conduits etc:—

PROCESS OF AND APPARATUS FOR COVERING WIRE WITH ASBESTOS. Ettore Albasini, Turin, Italy, 614,819. Filed May 29, 1898. Consists in feeding the asbestos to the wire and compressing the asbestos about the wire by pressure gradually and progressively applied.

METHOD OF FORMING ELECTRICAL CONNECTIONS. William B. Cleveland, Cleveland, O., 614,839. Filed May 9, 1898. Consists of casting one member upon the other, heating the two contiguous surfaces to a welding heat while free from atmospheric contact; supporting the casting in a die to prevent distortion; and uniting the two members by application of pressure while they are at a welding temperature and free from contact of atmospheric air.

JUNCTION BOX. Thomas J. Murphy, New York, N. Y., 614,882. Filed April 22, 1895. Renewed Dec. 31, 1897. Comprises an exterior wooden shell having a lining of a refractory, non-conducting material, a cover provided with a similar lining, and screw nipples extending through the exterior wooden shell against the lining, lining being countersunk and receiving a washer, with a washer on the outside of the wooden shell.

UNDERGROUND CONDUIT FOR ELECTRICAL CONDUCTORS. Charles H. Sewall, Chicago, Ill., 614,995. Filed March 2, 1898. The conduit ducts are formed or imbedded in a mass of hydraulic concrete or similar material.

Dynamos and Motors:—

DYNAMO-ELECTRIC MACHINERY. Joseph Slater Lewis and Felix John Howitt, Manchester, England, assignors to P. R. Jackson & Co., Ltd., of Manchester, England, 614,964. Filed March 12, 1898. In the armature are embodied additional coils connected between each armature coil and its corresponding commutator bar and a field magnet, the angular breadth of whose pole surface can be varied.

Electro-Metallurgy:—

ELECTRIC METAL-HEATING PROCESS. George D. Burton, Boston, Mass., 615,136. Filed Aug. 24, 1893. Consists in subjecting the parts to be heated while in contact with each other to the action of an electric arc sprung between them and an electrolytic bath.

PROCESS OF AND APPARATUS FOR SEPARATING METALS AND BY-PRODUCTS FROM ORES BY ELECTRICITY. George D. Burton, Boston, Mass., 614,927. Filed Jan. 25, 1897. Comprises a reducing chamber for containing ore to be melted, a precipitating chamber for the by-products, a pipe connecting the reducing chamber with the precipitating chamber and provided with magnets for arresting magnetic particles of metal, and means for heating the reducing chamber.

PROCESS OF AND APPARATUS FOR SEPARATING METALS FROM ORES BY ELECTRICITY. George D. Burton, Boston, Mass., 614,930. Filed April 11, 1898. Consists in subjecting the whole mass of ore under treatment to pressure, and simultaneously to an electric current of high amperage and low voltage, and causing the pressure to follow the diminishing mass of ore during the operation.

Miscellaneous:—

APPARATUS FOR PURIFYING LIQUIDS. Dexter Reynolds, St. Louis, Mo., 614,890. Filed April 3, 1897. Employs two sets of electrodes which are movable in the liquid to be treated, the electrodes consisting of zinc, iron, aluminum and antimony.

PROCESS OF TANNING HIDES OR SKINS OF ANIMALS. George D. Burton, Boston, Mass., assignor to the U. S. Electrical Leather Process Co., of Maine, 614,929. Filed April 5, 1898. Consists in placing the hides or skins in a tanning solution, passing an electric cur-

Digitized by Google

rent through the solution containing the hides or skins, then adding coloring matter to the solution, and again passing the electric current therethrough.

Railways and Appliances:—

TROLLEY FOR ELECTRIC CARS. Hosea W. Libbey, Boston, Mass., 614,875. Filed Jan. 11, 1898. Comprises a trolley head having two arms between which the main trolley wheel is mounted and a bracket on each side, between which and one of the arms, is mounted a small contact wheel.

TROLLEY DEVICE. James C. Fernald, Philadelphia, Pa., assignor to Joseph A. Smith and John H. Canavan, Philadelphia, Pa., 614,941. Filed April 19, 1898. Employs two contact wheels.

ELECTRIC RAILWAY. Hermann Theodor Hillischer, Vienna, Austria-Hungary, 615,176. Filed July 8, 1898. The current-supplying conductor is arranged in a channel running along the rails in the permanent way and a contact-making device secured to the car slides along the current-supplying conductor.

Switches, Cut-Outs Rheostats, Etc.:—

MECHANISM FOR CONTROLLING ELECTRIC CIRCUITS. George H. Whittingham, Baltimore, Md., 614,914. Filed April 5, 1898. Comprises a movable device which immediately controls or affects the circuit; a screw which imparts motion to the device; a pulley wheel carrying a lever which is adapted to engage the threads of the screw and thereby move it endwise in one direction; and means to place the lever in engagement with the screw.

AUTOMATIC TIME ELECTRIC-CIRCUIT SWITCH. Frederic Richard, Boston, Mass., assignor to the Universal Electric Clock Co., Boston, Mass., 614,982. Filed Oct. 30, 1897. Details of construction.

ELECTRIC SAFETY DEVICE. John F. Kelly, Pittsfield, Mass., 615,186. Filed April 14, 1898. A device for use in transformers, whereby when the insulation breaks down between the two conductors or a connection is made by other means the circuit will be automatically interrupted.

ELECTRICAL HINGE CONTACT. Channing Baxter, New York, N. Y., assignor to Albert S. De Veau, Mt. Vernon, N. Y., 615,209. Filed Nov. 21, 1895. Renewed Jan. 17, 1898. Details of construction.

Telephones:—

TELEPHONIC MICROPHONE. William D. Gharky, Philadelphia, Pa., assignor to George F. Payne, Philadelphia, Pa., 614,946. Filed Dec. 20, 1897. The electrodes are faced with material not readily oxidizable and backed by materials forming a thermopile and whereby the heat generated in the microphone is absorbed or conveyed away by the action of the current in the pile.

Bullishness All Around.

Last week presented some remarkable evidence of the spread of the bullish feeling that took possession of the business community after the victory for sound money at the elections, and while there were reactions and fluctuations, the tendency is steadily upward. Yet it would be unfair to say there is any "boom." Better prospects and better trade are expressing themselves in handsome percentages of growth, and that is all there is to it. Bradstreet's says: "Nearly all obtainable statistics and reports as to the volume of business point to the present year having heavily exceeded any former year in the amount of business done."

During the past week, 6,923 shares of Western Union were sold, closing at 93⅜. General Electric continued its rise, and on sales of 12,714 shares closed at 84¾. There are notable gains once more in New York Edison, which opened the week at 150½ and closed at 170, on sales of 2,412 shares. Is there a Metropolitan deal afoot? That street railway stock on sales of 48,830 shares, went from 176½ to 184, and a 7 per cent. dividend rate is declared. In Boston, Am. Bell Telephone was weaker, declining 1½ to 280½, but West End Railroad was ½ stronger, rising to 89.

Copper was held out for at 13 cents by the Lake companies, but business was done at 12⅞. Electrolytic was quoted at 12.60. A big deal in heavy steel rail marked the close of the recent uncertainty. The contracts represent about 750,000 tons, it is said, and the price is pretty close to $18. That quantity is 25 per cent. of American annual production.

WATERBURY, CONN. The Berlin Iron Bridge Company, of East Berlin, Conn., are erecting for the United Gas Improvement Company, Waterbury, Conn., the steel work for a generator room and an engine room. These roofs are to have steel trusses, supporting the roof covering. This covering is corrugated iron lined with the Berlin Iron Bridge Company's patent anti-condensation fireproof lining. The engine room has a span of about 33 feet, and the span of the generator room is about 51 feet.

The Tropenas Steel Process.

Less known perhaps in this country than in England and other Continental countries is the Tropenas steel process for the manufacture of steel castings and ingots. It has been in practical use abroad for over six years in the works of Edgar Allen & Co., Sheffield. The process consists briefly in the use of a special converter in which the pig iron melted beforehand is treated and converted into steel. When the melted pig iron has been run into the converter, the latter is turned in such a manner as to bring the lower tuyeres near the metallic bath, but always above it. The top tuyeres air valve is now closed. Then blowing is begun in this position until a carbon flame appears. When the operation is well underway, the top tuyeres valve is opened so as to admit through these tuyeres a supplementary quantity of air, which penetrates into the converter at a certain height above the metallic bath. This air meets the gases escaping from the metallic bath and burns them, thus producing a zone of high temperature, which, by radiation, considerably increases the heat of the charge.

The operation is stopped when the flame disappears—this corresponds to extra soft steel. Recarbonization is then made in the converter by means of a final addition, accurately weighed, thus allowing the plant to produce exactly the hardness and quality of steel required.

The characteristic features of the tuyeres process are the following: First—Low pressure blast, always above the surface of the metal and through the lower or "fining tuyeres." Second—Disposition of the tuyeres in the horizontal plane so that the jets of air, arriving above the bath, cannot impart to the latter any gyratory motion whatever. Third—Great depth of the metallic bath, so as to avoid churning and stirring during the operation. Fourth—Arrangement above the "fining tuyeres," and independent of the latter, of a supplementary row of "combustion tuyeres," so as to burn the combustible gases escaping from the metallic bath and thus increasing the final heat of the steel.

At the end of the Tropenas operation, before any final addition is made, the product obtained is practically pure iron. This enables the production of a very large number of steel castings for dynamos and other similar uses, possessing a very great magnetic permeability, and which, when analyzed, show from 99.75 to 99.80 per cent. of pure iron. These pieces are particularly sound and when machined show no blowholes or similar defects. This is most assuredly an indication of the great purity of the Tropenas metal.

A very interesting pamphlet giving the details of the process and illustrating the products, as well as citing a number of tests, can be obtained from the sole agents of the United States, Powell & Colné. 11 Broadway, New York.

Operating Church Organs.

The Emerson Electric Mfg. Co., of St. Louis, Mo., have recently completed, and are ready to furnish a device by means of which large church organs can be operated satisfactorily with the use of alternating current motors. This special adaptation of alternating current motors has been worked up in response to numerous inquiries extending over a number of years, and they believe that it is the only device on the market by which churches, placed beyond the range of direct current, can operate their organ bellows with an electric motor.

Printed matter describing this device is now in course of preparation and will be ready for distribution to interested parties within a short time. In the meantime the Emerson Company would be glad to receive inquiries from interested parties to whom they will send blue print and give all information.

THE B. F. STURTEVANT CO., of Boston, Mass., have just issued a second edition of their very suggestive pamphlet, Bulletin E, entitled, "Draft Without a Chimney." It will be mailed on application.

Digitized by Google

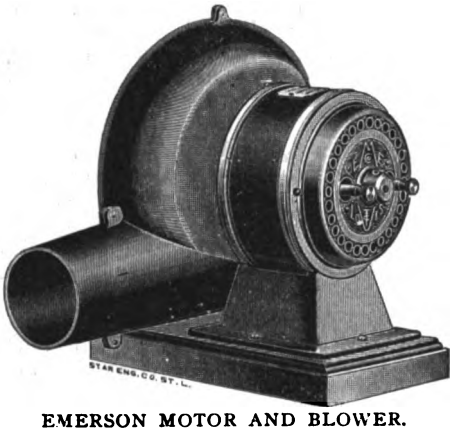
G. E. Enclosed Arcs.

"Enclosed Arc Lamps" is the title of the latest pamphlet issued from the General Electric press. It deals with the different types of enclosed arc lamps manufactured by the General Electric Company for direct and alternating current circuits, indoor and outdoor lamps, marine lamps, miniature lamps, power circuit lamps, series enclosed lamps, and single globe and double globe lamps. Each type is well illustrated, and the object of its design and its advantages set forth in language unhampered by abstruse technical expressions. It is written for the information of the general consumer as well as the electrician. Printing and illustrations are, as usual, excellent. The pamphlet will be sent to persons interested on application to any of the sales offices of the General Electric Company.

TRADE NOTES AND NOVELTIES

Motors as Forge Blowers.

WE illustrate herewith a very valuable adaptation of small electric motors for use as forge blowers. This is not only the cheapest but is also the best method of furnishing blast for all sizes of blacksmith forges. The air pressure is very much heavier than can be procured from any bellows or hand blower, and in addition it allows the workman to do at least one-quarter more work, as the blast is ready at all times and it is not necessary for him to devote any of his time to producing the air pressure. A great many of these are being used in some of the largest blacksmith shops in the country, and are



EMERSON MOTOR AND BLOWER.

giving universal satisfaction. With its use it is possible to get an even welding heat on a 4-inch axle much quicker and better than can be done by any other system. The motors furnished being of the induction type, have no brushes or commutator or other small parts to need adjustment or repair, and the outfit is guaranteed to work exactly as represented. Further information will be furnished interested parties by The Emerson Electric Mfg. Co., of St. Louis, Mo. We feel that this should be of interest to central stations at this season of the year, when blacksmith shops are usually crowded to their full capacity.

Instruments for Electro-Therapeutic Readings.

The report of the committee on meters of the American Electro-Therapeutic Association, made at the eighth annual meeting, has the following: "The alternating current meters, volt and milli-ampere meters, developed by the Keystone Electrical Instrument Company, have been in use throughout the past year, and have given, as far as construction and accuracy are concerned, perfect satisfaction. As was pointed out in the previous report the lowest reading obtainable with strict regard for scientific accuracy by the manufacturers was five volts and five milli-amperes respectively. Practical work has demonstrated that in the average application of the sinusoidal current these readings are sufficiently low as well as for gynecological applications of the induced current. But for percutaneous applications of the induced current as used extensively by the neurologist a lower reading both in volts and milli-amperes is desirable. This the manufacturers are trying to obtain. Mr. Stevens, manager of the company, reports that he has not yet succeeded in obtaining reduced scale readings. That is, he says, 'I have not succeeded in producing an instrument whose scale starts below 5 volts and 5 milli-amperes without introducing elements subject to uncertainty, whose indications cannot be absolutely relied upon. Very important results from a scientific point of view are frequently obtained from the indications of electrical instruments, and I feel that the maker is morally bound to do his best to produce instruments which shall be absolutely and invariably correct.' "

Electric Power in a Linoleum Factory.

The Nairn Linoleum Co., of Kearney, N. J., one of the largest concerns of the kind in this country, has placed contracts for an extensive electric transmission system, the switchboard and motors for which will be furnished by the C & C Electric Company. The switchboard will be a very complete and handsome one and will consist of three large panels, equipped with the very best makes of instruments. There will be nine motors installed, nearly all of them embodying some special features. As the highest efficiency attainable is one of the essential requirements and a wide range of speed variation is necessary in several of the motors, the C & C Electric Company will furnish part of the machines equipped with double commutators and field regulators. The installation promises to be a most interesting one and we hope later to be able to publish a more detailed description of the plant, accompanied by illustrations of the special machines.

Edison Extensions at Easton, Pa.

The Edison Electric Illuminating Company of Easton, Pa. are preparing to extend their plant, and will probably use water power from the Lehigh River, which is situated adjacent to their station property, as an auxiliary to their present steam plant. They are also considering the purchase of a direct connected unit of 400 h. p. This plant has always been able to produce current at a very low cost, but they believe by further improvements they can yet reduce the cost. Mr. Albert B. Herrick, their consulting electrical engineer, is preparing the plans for these improvements.

Ventilating the Boston Subway.

The thorough ventilation of the Boston Subway, as well as the prevention of any possible moisture, is receiving the careful attention that it deserves. A thorough circulation of air is necessary, and is to be secured by the operation of four special electric fans recently constructed and installed by the B. F. Sturtevant Co., of Boston. These are of the cone type, two of them 7 feet in diameter, and two 8 feet in diameter. Each is driven by a special Sturtevant direct-connected motor, and operating together they have a capacity equivalent to changing the air in that portion of the subway with which they connect, once in fifteen minutes.

More Use for Niagara Power.

It is announced by the Niagara Falls Power Company that on November 21 they closed a contract with the Union Carbide Company, for 15,000 electrical horse power, which power is to be used in a fine new carbide plant to be at once built on the power company's lands. The present plant will be continued in operation, but the new works will be erected on a new site. This site is north of the New York Central and the Erie tracks near the Niagara Junction Railway trestle. The buildings will occupy a large space and are likely to be built of brick. One of the new buildings will be over 800 feet long and two stories in height. The cables for carrying the power from the power house to the new works will be laid in a conduit under ground. The new plant will have connection with Buffalo avenue by a new road to be constructed by the power company, while the Niagara Falls Water Works Company will at once lay a main to the site. As stated, work on the new plant will commence very soon, in order that it may be ready for the current next summer, for that is the time the contract calls for its delivery. This contract for 15,000 electrical horse power means the product of

Digitized by Google

three of the immense generators in the central station of the Niagara Falls Power Company.

The Niagara Falls Power Company also announce having made a contract with the Electric Lead Reduction Company, a company in which Philadelphia capital is interested, and which will ocupy the two-story frame building on the power company's land formerly occupied by the Chemical Construction Company. As their name indicates, they will engage in manufacturing by an electro-chemical process. The industry is expected to grow to great importance.

The gentlemen interested in the Oldbury Electro-Chemical Company have organized a new company which will erect a new plant on the Niagara Falls Power Company's lands, east of the present plant of the Oldbury Electro-Chemical Company, and will use 800 horse power, the contract for which was signed Nov. 22. The buildings of the new plant will be of a substantial character, and will be commenced at once, the power contract calling for delivery of power by March 1, 1899.

ADVERTISERS' HINTS

THE PARTRIDGE CARBON CO., Sandusky, Ohio, are advertising dynamo and motor brushes.

HUEBEL & MANGER, 286 Graham street, Brooklyn, N. Y., say their style "F" bell is the best bell made and it pays to get the best.

GAS AND STEAM ENGINES are advertised by the Westinghouse Machine Co., Pittsburg, Pa. The gas engines range in size from 10 to 750 h. p. and the steam engines range in sizes of from 10 to 2,500 h. p.

THE HELIOS ELECTRIC CO., Philadelphia, Pa., are introducing the "Lilliputian" arc lamp, consisting of one coil, one plunger and one resistance. It is designed to burn on 110 volt direct current circuits. It measures 13½ inches over all, is wound for 3, 4, or 5 amperes and burns 25 hours.

THE ELECTRIC APPLIANCE CO., 242 Madison street, Chicago. say the "Packard Model '98" transformer is guaranted to give results superior to anything heretofore known in commercial transformer practice.

THE WILLIAMS ABBOTT ELECTRIC CO., Cleveland, Ohio, are now located in their new factory, 8, 10 and 12 Columbus street, that city.

THE AMERICAN PEGAMOID CO., 346 Broadway, New York, call attention to their "Enamelette," a waterproof composition not affected by petroleum, kerosene, benzine, turpentine; linseed, cottonseed or castor oils, salt air, water or atmospheric influences. The uses for such a compound are evident.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., offer to consulting and contracting engineers who have difficult problems for solution, the benefit of their extensive experience which should be invaluable in connection with knotty problems. They also say: "If you want literature upon any special subject or machine, write us, and we will cheerfully supply it if in stock."

THE CLEVELAND ELECTRIC TRADING CO., Cleveland, Ohio, publish a revised list of the specimen bargains in electrical machinery.

SOUTHERN NOTES

CARTER HAYS ELECTRIC CO. has been formed at Louisville, Ky., to make, buy, sell and repair electrical apparatus. The incorporators are L. D. Curtis, E. W. Hays and H. C. Hays, and the capital stock is $5,000.

HOUSTON, TEX. The Central Union Telephone Co. have let a contract to Reeves & Bailie for a new three story telephone building.

PEOPLE'S TELEPHONE CO., New Orleans, La., has begun to lay its conduits, beginning near its headquarters on Perdido and Carondelet streets. This "independent" company, which proposes to be running by May 1, 1899, has a list, it is said, of about 2,000 subscribers. Mr. W. P. Curtis is the general manager

The Okonite Co.

We are glad to inform the many friends of the Okonite Co. that their offices were entirely untouched by the disastrous fire which occurred in New York City on Sunday night, and which did attack one or two floors of the Postal Telegraph Building, in which the offices of the Okonite Co. are situated. In the words of Captain Candee, they are "still doing business at the old stand."

NEW ENGLAND NOTES

BERLIN IRON BRIDGE CO., of East Berlin, Conn., are erecting for the town of Whitehall, Washington County, N. Y., a riveted girder bridge having a span of about 70 feet. The bridge is of latticed girder type, with steel beams, and of a design to carry, besides ordinary traffic, the weight of a steam road roller.

A BIG FIRE broke out Nov. 30 in the car shed of the Union Railway Co. at Boston Road and Woodruff street in the Borough of the Bronx. The flames started somewhere in the vicinity of the paint shop. About 70 cars, and a lot of machinery and supplies were destroyed. For a time current was shut off at the power plant, stalling the whole system. The loss is put at $150,000, with $100,000 insurance.

THE E. A. PERKINS ELECTRIC CO. has been formed at Torrington, Conn., succeeding to the business of Mr. E. A. Perkins, who started in electrical construction there in 1890 and has made a specialty of isolated plants using Otto gasoline engines for power. He is now treasurer and manager of the concern. Mr. W. W. Mertz is president, and Mr. E. C. Franklin, secretary.

NEW YORK NOTES

MR. E. CALDWELL, well known in the electro-technical field of journalism, has with Messrs. O. O. Rouse and C. E. Robinson, lately of the Manufacturers' Advertising Bureau, formed a trade paper advertising agency, with offices in the American Tract Society Building, 150 Nassau street, New York. They propose to give their clients the best possible service.

MR. HERBERT B. COHO, manager of the New York office of the Eddy Electric Mfg. Company, reports business to be in a very satisfactory condition. He reports sales to The International Mfg. Company, Electric Vehicle Company, Benjamin Eastwood, Paterson, N. J., and the Watson Machine Works, Paterson, N. J., also a number of small equipments. The Eddy standard for excellence is maintained and the company will be very glad to see their friends at their new office, No. 143 Liberty street.

MR. FRANCIS GRANGER, dealer in general railway supplies, whose office has heretofore been at No. 35 Nassau street, New York City, has found it necessary to enlarge his office facilities owing to the material increase of his business, and advises us of his removal to larger quarters in the Havemeyer Building, No. 26 Cortlandt street, where he took possession December 1. Mr. Granger is the manufacturer of the Granger trolley wheels and anti-friction (babbitt) metals; is the Eastern sales agent for the Corning Brake Shoe Company, and has recently received the appointment of general Eastern agent for the Orient Electrical Company, manufacturer of the Orient incandescent lamp. Mr. Granger's staff consists of himself and two traveling salesmen, and a corps of general office assistants.

D. A. HUEBSCH & CO., of New York, have just finished delivering 100,000 Year Books for 1899 to the M. J. Breitenbach Co., of the same city. The Breitenbach Co. are the proprietors of the remedy known as "Gude's Pepto-Mangan," a preparation which they desire physicians to prescribe in cases of anæmia, etc., and, appreciating the value of Huebsch's Year Book as a medium for effective advertising, they are preparing to send a book to each doctor in the United States. As each Year Book contains 368 pages, and is handsomely bound in cloth, the magnitude of this lot of books cannot be easily grasped. About 25 tons of paper was used, and six large cylinder presses were kept running steadily for over two weeks.

Digitized by Google

MR. A. M. YOUNG, general manager of the Kings County Electric Company, which has absorbed the Brooklyn Edison Company, is making plans for physical consolidation of plant, about 60 days being necessary for the work, it is said. Various economies are expected to follow.

MR. H. A. MAY, of Syracuse, N. Y., has moved from the Everson Building to a large store on West Fayette street. Mr. May will, with his new store, be able to carry a large stock of electrical supplies manufactured by the numerous companies he represents.

STANDARD ELECTRIC CONSTRUCTION CO., of Rochester, N. Y., just incorporated, will not only increase their electrical construction facilities, but will carry a full line of dynamos, motors and general electrical supplies. The incorporators are E. H. Freeman, W. H. Tobey and B. A. Vandy.

FOREIGN NOTES

MR. NORMAN H. SCHNEIDER, who recently severed his connection with the export department of the Western Electric Co., of New York, has become the Havana representative of Krajewski-Pesant Co. He begs to announce that they have opened a wholesale and retail store in Havana at O'Reilly 15, where they intend to handle machinery and all kinds of electrical supplies. Besides being sole Cuban agents for a number of prominent American firms, they also represent the General Electric Co. of England.

ENGLISH "ELECTRICAL TRADES DIRECTORY." The London "Electrician" has sent out the slips for its 1899 edition of the "Electrical Trades Directory and Handbook," and will be glad to receive all such slips promptly by return, as the book issues early in January. It will be larger and more valuable than ever.

GOTHENBURG, SWEDEN, is to have four electric trolley lines by 1900, with overhead construction, with reversion to the city after twenty years.

GLASS CASING for underground cables is said to have been used with success at Marseilles, France, the tubes proving a good protection against dampness, etc.

WESTERN NOTES

THE CITY OF ELKHORN has successfully started the electric plant, the power for which is furnished by a 125 h. p. tandem compound engine which was built by the Ball Engine Co., Erie, Pa.

MR. EUGENE H. M. LOUREY, for a long time identified with electrical supply interests in St. Louis, has recently joined the forces of the Central Electric Co., of Chicago, as city salesman for the electric fixture department.

THE SCHOENHOFFEN BREWING CO., Chicago, has recently installed a 100 h. p. engine, built by the Ball Engine Co., direct connected to a 60 k. w. Western Electric Co. generator.

THE ELECTRIC APPLIANCE CO. report that they are meting with splendid success with the 1898 model Packard transformer, and that it is more than fulfilling all the claims and guarantees that they have made. An "X-ray" illustration on one of our advertising pages shows the interior construction of the transformer and gives a good idea of the substantial way in which it is built.

MR. FREDK. SAXELBY, an engineer well known throughout the electrical trade, and formerly connected with General Electric and Siemens-Halske interests in this vicinity, has allied himself with the Bullock Electric Co., and will now handle their apparatus in this territory.

THE CENTRAL ELECTRIC CO. announce that they are making great preparations for the usual holiday trade in miniature lamps for decorative purposes. They are carrying large stocks of these lamps in clear and natural colors, in all candle powers and voltages. They are also introducing a new type of standard base miniature lamp operative upon circuits of 90 to 130 volts. Its small dimensions render it particularly adapted to sign work or most all kinds of decorative purposes.

ELECTRICAL APPLIANCE CO. We are pleased to note that Mr. G. A. Nisbet, president and general manager of the Electrical Appliance Company, Thames street, New York, has successfully closed an arrangement with the Northern Engineering Company, 39 Cortlandt street, whereby the latter are now lessees and will handle the gravity, motor controller and pump controller throughout the United States and Canada under the personal supervision of Mr. G. A. Nisbet. We have no doubt but what the Northern Engineering Company will do well on these specialties through Mr. Nisbet having been quite successful, and is very favorably known throughout the electrical trade.

THE CENTRAL ELECTRIC CO. are introducing a new type of shade holder called the "Ideal," which is ideal in many respects, its advantages being that it is made from one piece of metal and so constructed that it will not get out of shape, the common fault with most types of shade holders.

CAYUGA, IND. The Cayuga Telephone Company has passed into the ownership of County Supt. of Schools, Grant Gossett. Mr. J. E. Russell is manager. The equipment is of Victor make, with switchboard of 100 drops capacity. There are 67 subscribers, 8 miles of local circuit and 28 miles of toll line. The rates are $2 and $1.50 per month, and tolls 25 cents to all points. Three metallic circuits are in construction to Silverwood, three miles away, with a wire span across the Wabash of 800 feet. Mr. Russell says that 18 arcs and 200 or 300 incandescents, with motors, could be used profitably.

CONTENTS.

EDITORIALS:
Our Export Trade 562
Two Presidential Addresses 562
The Enclosed Arc Lamp 563

POWER TRANSMISSION:
The Hamilton, Can., Cataract Power Co.'s Plant at De Cew Falls (illustr.) ..... George W. Bowie. 553
Niagara Power Development in Canada 556
High Voltage Power Transmission—III. (illustr) ..... Charles. F. Scott. 557

ELECTRIC LIGHTING:
A Gas Engine Electric Lighting Plant for the French Chamber of Deputies (illustr.) 559
The Mechanical Plant of a Modern Commercial Building—I. ..... William H. Bryan. 560
The Effect of Fire Damp on Incandescent Lamps 561

MISCELLANEOUS:
The Volunteer Engineers and the Engineers' Club ..... Colonel Eugene Griffin. 561
Pulp Bleaching at Muncie, Ind. 561

ELECTRIC TRANSPORTATION:
Surface Contact Electric Railways—III. (illustr.), (Concluded) .... Edward H. Johnson. 564
Surface Contract Street Railroad at Monaco (illustr.) 565

TELEPHONY AND TELEGRAPHY:
A New Telephone Exchange for Brussels, Belgium 566
Telephone Opposition in New York City.—Private Telephone for Packing Houses.—Penny Rate Proposed for Cablegrams.—Claims for Cutting Cuban Cables 567

MECHANICAL:
Cooling Tower and Condenser Installation ..... J. H. Vail. 567
Russell Co.'s Engines, Massilon, Ohio (illustr.) 568

SOCIETY AND CLUB NOTES:
Nineteenth Annual Meeting of the American Society of Mechanical Engineers 570
Missouri Independent Telephone Association 571

NEWS AND NOTES:
Exports of Electrical Material from New York.—American Steam Engines Wanted in France.—The Hum of the Horseless.—Electrical Undertakings in Our Colonies.—Lighting Consolidation in Montreal 571

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents Issued November 22, 1898 572
Classified Digest of U. S. Electrical Patents Issued November 29, 1898 572

THE STOCK MARKET:
Bullishness all Around 573

CATALOGUES:
The Tropenas Steel Process.—Operating Church Organs.—The B. F. Sturtevant Co. 573
G. E. Enclosed Arcs 574

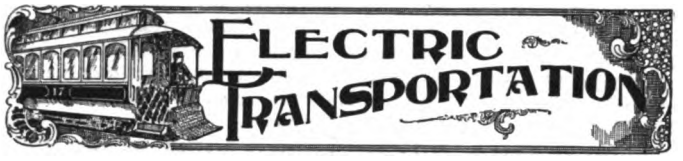
TRADE NOTES AND NOVELTIES:
Motors as Forge Blowers (illustr.).—Instruments for Electro-Therapeutic Readings.—Electric Power in a Linoleum Factory.—Edison Extensions at Easton, Pa.—Ventilating the Boston Subway.—More Use for Niagara Power 574
Advertisers' Hints.—Southern Notes.—New England Notes.—New York Notes 575
Foreign Notes.—Western Notes 576

Department News Items will be found in advertising pages.

Digitized by Google

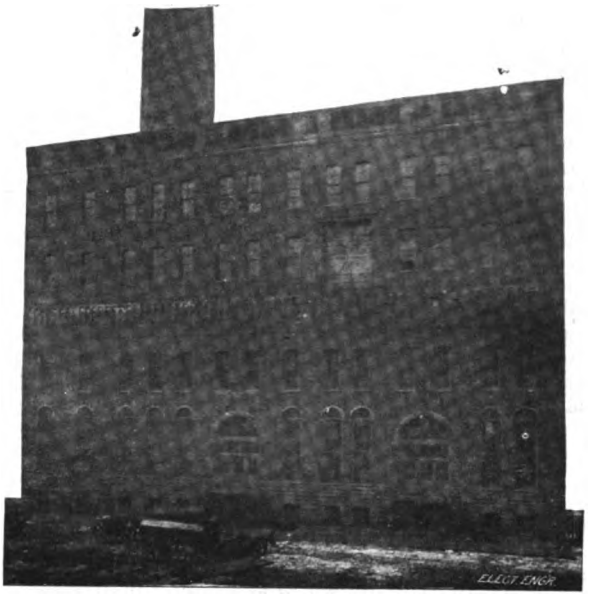
The Electrical Engineer.

Vol. XXVI. DECEMBER 15, 1898. No. 554.



Union Elevated Railroad Power House, Chicago.

THE power house of the Union Elevated Railroad Company, of Chicago, was started in construction some two years ago, but owing to various delays in completing the road it is only recently that the power house has been brought to what



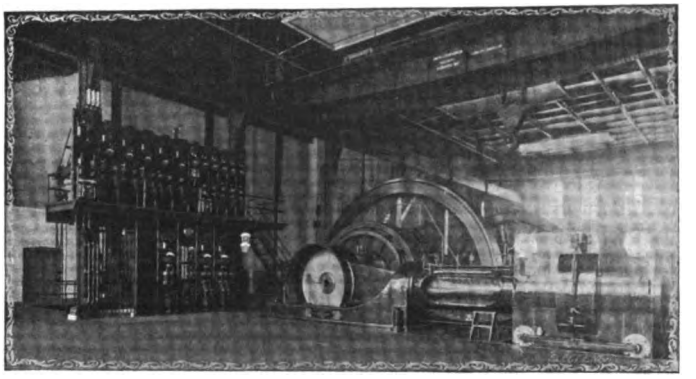
POWER PLANT, UNION LOOP, CHICAGO.
(Smokestack Not Fully Shown.)

might be called a finished state. The Union Elevated Railroad Company was formed by those interested in the four elevated roads of Chicago for the purpose of securing a common down-town terminus or loop for their respective lines. Considerable difficulty was, of course, experienced in securing frontage consents and franchises for such an elevated loop in the congested

BOILER ROOM, WITH OIL FUEL APPARATUS, UNION LOOP.

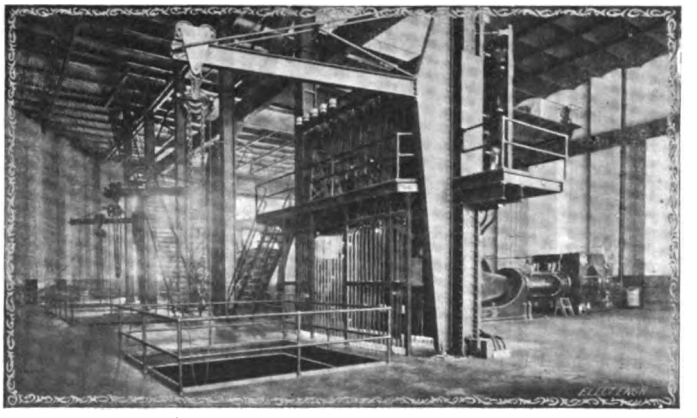
heart of Chicago's business district, but it was important that such a loop be built before the elevated roads of Chicago could expect to do much business, or before they could be a great convenience to the general public, as their terminals, before the loop was built, were a long walking distance from the greater part of the down-town district. The structure of the Union Elevated Railroad comprises a loop of two miles in Lake street, Wabash avenue, Van Buren street, and Fifth avenue, encircling the most crowded part of the business district. Three roads are now operating over the loop, the Metropolitan West Side Elevated, the South Side Elevated Railroad and the Lake Street Elevated Railroad, the amount of business done by the three being about in the order named. A fourth road, the Northwestern Elevated Railroad, which will serve the north side of Chicago, is now under construction, and will use the Union loop also when finished. The loop has two tracks, the plan being to have two roads use each track. The traffic on the loop is very heavy during rush hours, and as the stations are but a short distance apart, the demand for power in accelerating trains is large.

The power house is on the Chicago River, at Market street, about 300 feet south of Van Buren street. This is three blocks from the southwest corner of the loop proper and only 300



SWITCHBOARD AND GENERATING UNIT, UNION LOOP POWER PLANT, CHICAGO.

feet from the structure of the Metropolitan Elevated. Feeder cables are run underground to this structure at Market and Van Buren streets, and from thence they are run under the structure. Each of the two tracks on the loop is divided into two sections and the four sections are fed independently. Two-story power stations have never been popular, and very few of them can be found the country over, but in this case the double-deck plan seemed to be a necessity because enough land could not be secured to put everything on the main floor. The station was, therefore, built with the engines on the main floor and the boilers on the second floor. As oil is used for fuel, this form of construction has not the drawbacks that it would have if coal and ashes were to be handled. The lot on which the power house is located faces Market street, and its back line is on the river. The Market street front is considerably wider than the river front, the dimensions of the lot and building being 141 feet on



BACK OF SWITCHBOARD, UNION LOOP.

Market street, 61 feet on the river, and 164 feet in depth along the north line. The height of the building above the street

Digitized by Google

grade is 100 feet at the Market street front and from there the roof gradually slopes back toward the river.

The basement floor is 6 feet below the street grade and the basement is 15 feet high. The engine room above this is 36 feet high. Then comes a floor suspended from the boiler room floor for convenience in ash handling, and for smoke flues to boilers from the stack. This floor takes up 12 feet of the height of the building. Above it comes the boiler room, 37 feet high. The boilers rest on box girders 44 5-16 inches deep, and these are carried on other girders of about the same depths supported by columns 18¼ feet apart. On the engine room floor provisions are made for four 1,500 k. w. direct connected units, of which three have already been put in. The generators are Siemens-Halske, with internal pole-pieces, and the armature carried on a spider and overhanging the pole-pieces. Instead of having the armature windings form the commutator, however, and having the brushes bear directly on the armature as with previous generators built by this company, independent commutators are employed on these machines. The engines to which they are connected were built by the Corliss Engine Company, of Providence, R. I. They are cross-compound, condensing, 30 and 60 inches by 60-inch stroke, running 75 revolutions per minute. Wheeler surface condensers are used and condensing water is taken direct from the Chicago River. The circulation of condensing water is kept up by a rotary pump direct connected to a small engine, one for each unit. Between each engine and its condenser a Wheeler feed-water heater is inserted in the exhaust and in addition to this there are secondary feed-water heaters which take the exhaust from the air pumps, feed-pumps and auxiliary engines. The feed pumps are of the Blake duplex admiralty type, three in number. Each of the generating units is provided with a Cochrane oil separator. Although river water is used for the condensers, city water is used to make up for what water is not supplied back to the boilers from the closed surface condensers. Owing to the shape of the power house not being a rectangle, a triangular space is available south of the row of engines and generators, and this space is used in the basement for the condensers. The engine room floor is open just over each condenser and over each swings an 8-ton post crane attached to the steel posts in the engine room. A Crane air pump, direct acting, supplies air to a compressed air system for blowing out armatures, etc.

On the second floor are sixteen 400 h. p. Babcock & Wilcox water-tube boilers. These are all equipped with Acme mechanical stokers built by the Falls Rivet and Machine Company, but at present oil fuel is used, so that the stokers are not in use. The fuel oil circulating system of the National Supply Company, of Chicago, is employed. Fuel oil is delivered from the street to the southeast corner of the basement and pumped from there to the second floor. In case coal is used, there is storage room for 2,000 tons in part of the triangular space along the south side of the building and coal conveyors will be run up beside the stack. Ashes can be delivered from the sub-floor of the boiler room to either the street or the river fronts. Provision is made for driving the stokers from a line shaft driven by small Buckeye engines. The stack is brick, 240 feet high, with a 13½-foot flue. It is 24 feet in diameter at the base. The engine room is spanned by two traveling cranes running on 27-inch crane girders. The cranes span 50 feet 8 inches.

All the interior minor wiring of the station is done in iron-armored conduit. The main cables from the switchboard are run in the usual manner, on porcelain supports. The switchboard has four generator panels and one main panel. The main panel has two Type M. Thomson recording wattmeters. Each takes the current from two generator panels. The generator panels have the positive and negative quick-break General Electric switches, 5,000 ampere Weston ammeters and General Electric circuit breakers. They also have the field rheostats and the usual Siemens and Halske device for slowly breaking the field circuit to avoid the danger of puncturing the insulation by the inductive discharge. This device consists of a pair of arc light carbons and a small hand crank geared with a worm gear to a mechanism for separating the carbon points. The field circuit is completed through the carbons when the points are together and a knife switch also affords a low resistance bypath when the generator is in continuous operation. When the field circuit is to be opened this bypass switch is first opened, so that the entire field current passes through the carbons. Then the crank is turned and the carbons are slowly drawn apart, forming an arc which finally becomes so long that the field circuit weakens and the arc goes out, breaking the circuit. In this way the current is made to die down gradually.

On a gallery over the generator panels are the feeder panels. Four of these are for the four sections of third rail on the loop, several are for the emergency supply of surface electric lines, and one is for the light circuits to the elevated stations. There is also a panel which may be called a relief or substitute panel which is not usually found on railway boards. This is for the purpose of allowing the regular circuit breaker on each panel to be thrown out of use for repairs and cleaning without interfering with the 24-hour service. This panel with its ammeter and circuit breaker can be shunted around any circuit breaker on any of the feeder panels. On each feeder panel are two single-pole switches, one of which connects the feeder to the regular bus-bar through its regular circuit breaker and the other of which connects the feeder direct to a bus-bar from the substitute panel, so that the feeder in question is then supplied through the circuit breaker of the substitute panel. This substitute can also be used in multiple with any regular panel to carry unusual loads. Such large circuit breakers as these require close attention—and prompt attention—after they have opened several times in succession, or great damage is likely to follow. The point to be especially looked after is to see that the circuit is broken at the copper main contacts before it is broken at the magnetic blow-out contacts. If the blow-out contacts become worn and burned so that they break contact before the main contacts are opened, the arc is made at the main contacts where there is nothing to blow it out, and with such a current the arc is liable to destroy the breaker. This station is also connected direct with the West Chicago Street Railroad power house at Western avenue and Washington boulevard and with the North Chicago Street Railroad power house at Hawthorne avenue and Hobbie street. This is done by running cables direct from the bus-bar of one station to the bus-bar of the other. These circuits come in to the bus-bar through feeder panels of the ordinary type. The stations are thus tied together, of course, to provide for helping each other out in case of necessity and taking care of "owl car" loads efficiently.

The power house was originally designed by S. Potis, Jr., chief engineer, and the electrical features are under charge of James R. Chapman. S. S. Neff is superintendent of the Union Loop.

A New Riker Electric Delivery Wagon.

Mr. A. L. Riker, of the Riker Electric Motor Company, Brooklyn, has been building several delivery wagons for the Gorham Manufacturing Company, the well known silversmiths. The wagon is shown in the accompanying illustration. It weighs

RIKER ELECTRIC DELIVERY WAGON.

complete without load 3,200 pounds. It has a mileage capacity of nine miles per hour, and thirty miles on each charge of the battery. The weight of the battery is 1,000 pounds, and it consists of 40-7 M. V. chloride cells. The batteries are in the box below the body, so that the body is entirely free for the load. It has 32-inch front wheels and 36-inch rear wheels, with 3-inch

Digitized by Google

pneumatic tires, pumped to 125 pounds. It has one 2½ k. w. motor geared to the rear axle, with a reduction of ten to one. The carrying capacity is 1,000 pounds, exclusive of driver and delivery man. It has three speeds forward and two back, all the changes being effected by the same lever. The forward movement of the lever sends the vehicle ahead. Returning the lever to a vertical position reverses the direction of the vehicle. The method of steering is the one usual in Riker carriages, namely, the pivoted hub.

It deserves mention that the first of these delivery wagons was out in all the late severe snowstorm, and accomplished its work without any difficulty whatever.

Woods' Electric Moto-Vehicles.

By courtesy of the Fischer Equipment Company, of Chicago, Ill., sole manufacturers of the Woods' moto-vehicles, we are enabled in the present issue to present some of their most recent productions in this line. Fig. 1 illustrates a group of Woods' moto-vehicles as assembled before the Calumet Club, of Chicago, preparatory to a run for a special party on the boulevards and avenues of their city. The different types and characters show the art of the carriage builder, as well as the electrician and mechanician. The work of Mr. Woods in behalf of his company has been exclusively toward the production of fine artistic carriages in all of the various styles and characters known to the carriage maker's trade rather than the mere production of a self-propelled machine. The company offer now some twenty-five different styles of carriages from which the purchaser may make a selection—in fact, about the same range of diversity in design is offered in the Fischer Equipment Company's line of moto-vehicles as is found in any of the large carriage manufacturers' catalogues of the ordinary vehicles drawn by horses.

The company are thoroughly equipped in their factory to manufacture this class of work, as they manufacture the complete vehicle, including everything that goes to make up the vehicle except the rubber tires. This insures to the purchaser a uniformity of work, an access to interchangeability of parts and a protection in guaranties which can in nowise be offered under any other conditions of manufacture.

Their Victoria hansom cab is equipped with two 3½ h. p. motors, sufficient battery capacity to run thirty miles with one charge of the batteries, has electric lights in the side lanterns, and electric lights and electric foot-warmers in the interior of the body. It is designed for use on any and all city streets, and runs at a maximum speed of twelve miles an hour.

The hansom cab shown in the figure is similarly equipped, except that the driver sits back of his passengers instead of in front of them. The finish of these vehicles is in keeping with thoroughly first class work and the manipulation of them is reduced to such a simplicity as enables any driver of ordinary intelligence to learn to operate them. The total weight of these cabs is 2,600 pounds each.

Their road buggy is said to be the lightest that has ever been built by them, the total weight of which is but 750 pounds. The equipment consists of one 2½ h. p. motor, sufficient battery capacity to run the vehicle twenty-five miles on one charge, has a maximum speed of twelve miles an hour, and seating capacity for two passengers.

WOODS' ELECTRIC HANSOM.

One noticeable thing in the Woods' moto-vehicles is that wood wheels and hard rubber tires are used almost exclusively. In practical tests of both wire wheels and pneumatic tires and wood wheels and hard rubber tires, it has been demonstrated to them that the latter are far more desirable and durable in many ways than the former. They not only lend a far more satisfactory appearance to the vehicle, but with these wheels and tires the vehicle consumes less power and all annoyances due to punctures and such difficulties are entirely eliminated.

The Fischer Equipment Company are making arrangements to build a very large number of Woods' electric cabs for use in the city of Chicago and some of the other larger cities, and at

A GROUP OF WOOD'S ELECTRIC VEHICLES.

Digitized by Google

the present time are filling many orders for private use and also building a number of vehicles for European trade.

The control and operation of the Woods' moto-vehicles has been reduced to such simplicity that they are susceptible of operation by any purchaser with a few moments' instruction. It is impossible to apply the brake to these vehicles without first cutting the power off from the motors; also impossible to apply the power without first liberating the brake, due to an interlocking device between the brake and controller, the operation of both controller and brake being performed by one handle. A separate reversing switch is used by which all of these vehicles are made to operate exactly the same running backward as they do forward, and which is provided with a lock, so that when the key is removed the vehicle cannot be operated by anyone not possessing the key. The various speeds are obtained by series-paralleling the batteries, and in this work great pains have been taken to insure a uniformity of discharge from the batteries when in parallel. Contacts and connections having nearly four times the cross-section ordinarily required are used so that the resistances may be perfectly uniform.

On the light road buggy but one motor is used with a differential gear, but aside from this one departure, all of the Woods moto-vehicles for hard and heavy work are equipped with two motors, one attached to either rear wheel, and every provision is made for automatic adjustment in the turning of corners or the turning of the vehicle around.

The motors themselves are built with ironclad armatures and special coil windings, which coils are wound before being placed upon the armature. This enables the coils to be shipped anywhere and they can be fitted into the armature without any difficulty whatever by those who understand anything about armature winding.

The batteries are all arranged to be either removed from the

No. of Vehicle	No. of Equipment	NAME OF VEHICLE	Weight of Complete Vehicle lbs.	Weight of Batteries Only lbs.	Average Miles Run on One Battery Charge	Speed Miles Per Hour 1st	2nd	3rd	Horse Power in Motors	Time in Hours Required to Charge Batteries	No. of Battery Cells	Size of Wheels Diameter Front	Rear	Per Cent Grade Vehicles will Climb	Cost to Maintain Batteries Per Year	Cost to Run Per Mile
½	½	Road Wagon	775	440	20	3½	7	14	2½	3	40	32"	32"	8	$ 50 00	½
1	1	Runabout Buggy	1000	600	20	3½	7	14	3	3	40	36	42	6	60 00	1
2	1	Park Buggy	1100	600	25	3½	7	14	3	3	40	36	42	8	60 00	1
3	2	Park Trap	1800	800	25	3½	7	14	4½	3	40	36	42	8	80 00	1½
4	2	Brake	1800	800	25	3½	7	14	4½	3	40	36	42	8	80 00	1½
5	2	Surrey	1850	800	25	3½	7	14	4½	3	40	36	42	8	80 00	1½
6	1	Stanhope	1200	600	18	3½	7	14	3	3	40	36	42	8	60 00	1
6	2	Stanhope	1500	800	25	3½	7	14	4½	3	40	36	42	8	80 00	1½
7	1	Phaeton	1200	600	18	3½	7	14	3	3	40	36	42	8	60 00	1
8	2	Spider	2000	800	25	3½	7	14	4½	3	40	36	42	8	80 00	1½
9	3A	Full Mail Phaeton	2400	1000	20	3½	7	14	6½	3	40	36	46	8	100 00	2
9	3B	Demi Mail Phaeton	2100	800	25	3½	7	14	4½	3	40	36	46	8	80 00	1½
10	2	Physicians Coupe	1800	800	25	4	8	16	4½	3	40	36	42	8	80 00	1½
11	3	Hansom Cab	2400	1000	20	3	6	12	6½	3	40	32	38	8	100 00	2
12	3	Victoria Hansom Cab	2700	1000	20	3	6	12	6½	3	40	32	38	8	100 00	.2
13	3	Brougham	2400	1000	20	3	6	12	6½	3	40	32	38	8	100 00	.2
14	2	Victoria	1600	800	25	3	6	12	4½	3	40	36	42	8	80 00	.1½
14	3	Victoria	2000	1000	20	3	6	12	6½	3	40	36	42	8	100 00	2
15	3	Landau	2800	1000	20	3	6	12	6½	3	40	32	38	8	100 00	.2
16	2	Station Wagon	1900	800	25	3	6	12	4½	3	40	36	42	8	80 00	.1½
16	3	Station Wagon	2200	1000	20	3	6	12	6½	3	40	36	42	8	100 00	.2
17	1	Coach Delivery Wagon	1300	600	18	2½	5	10	3	3	40	36	42	8	120 00	.1½
17	2	Coach Delivery Wagon	1700	800	25	2½	5	10	4½	3	40	36	42	8	140 00	.1½
17	3	Coach Delivery Wagon	2000	1000	20	2½	5	10	6½	3	40	36	42	8	200 00	.2½
18	1	Hood Delivery Wagon	1200	600	18	2½	5	10	3	3	40	36	42	8	120 00	.1½
18	2	Hood Delivery Wagon	1700	600	25	2½	5	10	4½	3	40	36	42	8	140 00	.1½
18	3	Hood Delivery Wagon	2000	1000	20	2½	5	10	6½	3	40	36	42	8	200 00	.2½
19	4	Theatre Bus	2800	1400	25	2	4	8	9½	3	80	32	38	8	300 00	.4
20	4	Depot Bus	2800	1400	25	2	4	8	9½	3	40	32	38	8	200 00	.4

DATA ON WOODS' MOTO-VEHICLES.

vehicle for duplicate sets or to be charged standing in the vehicle.

A long line of experimental work has resulted in an absolutely noiseless operation as special compositions in rawhide are used which have no resonance whatever in the performance of their work. We are assured by the manufacturers that the mileage quoted is nearly 25 per cent. less than the actual mileage capacity obtainable as these mileage capacities are their guaranteed figure. Varying conditions of road and weather as well as the fact that sometimes batteries are not quite fully charged when starting out, has led this company to make this mileage capacity statement on the most conservative lines. The excessive cost for delivery wagons and public conveyances in their maintenance is due to their much greater service demand than for vehicles in private use only.

MR. ALBERT RHETT, of Washington, D. C., has, it is stated, accepted the position of assistant electrical engineer with the Missouri Edison Co., of St. Louis, Mo. He graduated last June, and since then had been engaged in electrical work in the Far West.

A Paris Underground Electric Road.

A special dispatch from Schenectady, of Dec. 8 says: An order for the equipment of an underground railway in Paris, now under construction, is being executed by the General Electric Company at the works in this city. The entire equipment will be furnished by the company, and the order is one of the largest ever received at the works from a foreign source.

The order was received after sharp competition with other companies. The tunnel will be patterned after the one used by the New York Central in New York. The trains will be drawn by electric locomotives similar in design to those used on the Central London underground railway.

Five of the locomotives now being built are reported as being well along. There will be eight of the machines in all, of the latest and best type, and the entire equipment will be the best product of American ingenuity. The road will be three miles long, and a large traffic is expected by the promoters of the enterprise. It is expected that the work can be finished in a short time as some departments of the General Electric works are running day and night.

The work in hand represents $150,000, but it is expected that it will be largely increased, as it is proposed soon to lengthen the lines of the company.

Extensive Connecticut Trolley Projects.

The Meriden, Southington & Compounce Trolley Co. has given notice of a petition to the next Legislature for permission to increase its capital stock to $500,000, and to extend its line to Waterbury, to Cheshire, to Mount Carmel, to the top of West Peak, to Berlin, and through certain Meriden streets, the whole involving extensions of about 40 miles.

CHIEF ENGINEER MARTIN, of the Brooklyn Bridge, reports that structure as safe, all reports to the contrary notwithstanding.

High Voltage Power Transmission.—IV.[1]

BY CHAS. F. SCOTT.

(Concluded.)

THERE appears to be practically nothing in power transmission in Europe using high potentials outside of Switzerland. The installation in Paderno in Switzerland is operating at 15,000 volts, the highest voltage which has been used in that country. The damp weather is one of the limiting factors. The insulators used are porcelain with a triple petticoat.

The highest voltage which is used for transmission is in the Provo plant of the Telluride Power Transmission Company in Utah, which transmits power 35 miles to the Mercur mills at 40,000 volts. Raising transformers are three in number and are connected in the star form. Each transformer has a capacity of 250 k. w. The middle points of both the high-tension and low-tension circuits are grounded. In general design these transformers resemble the transformers used in the high-tension tests at Telluride; the design and construction having been under the direction of the same man in both cases. The line extends from Provo, at an elevation of 4,500 feet to Mercur, at 2,000 feet above Provo, and the line reaches an extreme height of about 10,000 feet above the sea level. Three miles of the line are strictly mountain construction. The lightning protection is afforded by choke-coils and Wurts' non-arcing metal arresters. The insulators are of glass. The design was based on the tests at Telluride, and they were made especially for this plant. The insulators are held on special pins of oak which are thoroughly paraffined. The lower part of the insulator is 5 inches above the cross-arm.

In dry weather there has been no difficulty whatever in operating. The insulators do their work as effectively as could be expected if the voltage were only a few thousand volts. When every-

[1]Abstract of a paper read before the 15th general meeting of the A. I. E. E., Omaha, June, 1898.

Digitized by Google

thing is dry, the line will operate without difficulty, even if some of the insulators are off and the wire rests upon the cross-arm. When it rains there is sometimes trouble. It is indicated in the station by the ammeters giving quick swings, showing momentarily strong currents. Sometimes this is apparently a short-circuit and blows a fuse. In every case when there has been trouble on the line it has been in rainy weather, and broken insulators have been found which located the trouble. It is certain that in most cases these have been previously broken—by bullets, and in other cases it is probable that the insulators were likewise broken. It is believed therefore that had there been no intentional breakage of insulators there would have been no trouble upon the line since the plant began operating in February last. A few of the insulators near the station are not far from the overflow and are in a moisture equivalent to a rain all the time without doing any damage. Snow has often backed from the cross-arm up against the bottom of the insulator and around the first petticoat. It is usually found that the part of the insulator around and near the wire does not receive deposits of moisture or frost but remains dry, the particles being repelled. At this plant, current for about 700 h. p. is carried through three fuses of copper wire 0.01 inch in diameter. Iron wire is used on a branch line for transmitting about 100 h. p. for about three miles.

This plant has been in operation in winter and in summer, "in thunder, lightning or in rain," the sole supply of power for the enormous De Lamar mines and mills, at Mercur, and is a happy and fitting consummation of the high-tension tests described in the beginning of this paper.

LIMITATIONS OF HIGH-VOLTAGE TRANSMISSION.

The important commercial question is: To what distance can power be transmitted? The relation between distance and voltage is well known. The same weight of copper can transmit with equal efficiency the same power to any distance, provided the voltage is increased directly as the distance is increased. The limiting commercial ratio between voltage and distance is easily found. If the distance be three miles per 1,000 volts and the loss 16 per cent., the cost of copper is about $20 per h. p. The interest on the latter investment is about $1 per year. A distance in miles equal to three times the number of thousand volts may therefore be covered without an excessive annual charge per horse power for copper. The limits to the voltage which are practicable depend principally upon the insulator and upon the loss between wires.

The Insulator.—The two fundamental requirements are dielectric strength sufficient to prevent puncture, and a size and form which will prevent the passage of the current around the insulator. A given insulator will be adequate for a higher voltage where the atmosphere is comparatively pure and dry, than it will be under other conditions. The rapid progress which has been made in the design and construction of insulators during the last few years, will doubtless provide an insulator which will accommodate the highest voltages that can be used due to other limitations. The insulator therefore while remaining the critical point in a transmission system will probably not determine the limit of practical voltages.

Loss Between Wires.—The loss between bare wires at high voltages seems to determine a positive limit, beyond which the voltage cannot be increased. This loss is subject to variation due to diameter of wire, distance between wires, and wave form of the e. m. f., but the variations which may occur under favorable commercial conditions locate the point of increase of loss about 50,000 or 60,000 volts. Under favorable conditions this may be raised somewhat, but it is not probable that any material increase can be made.

Amount of Power.—The amount of power to be transmitted involves some interesting commercial limits. There are certain elements in a transmission which do not vary greatly with the amount of power transmitted. Thus, the charging current to the line will be practically the same whether the wire will transmit 1,000 h. p. or 100 h. p. If the charging current happens to represent 300 h. p. it would be insignificant in one case, but for the smaller output it would require generating apparatus several times that necessary for the actual power.

It is not mechanically practicable to use wires as small as would be sufficient, in so far as conductivity is concerned, for transmitting a small power. For example, a No. 7 copper wire, which is as small as is ordinarily used, if employed in a 3-phase circuit 50 miles in length, will transmit over 1,000 k. w. at 40,000 volts with 10 per cent. loss. If only a few hundred kilowatts were to be transmitted, the cost per kilowatt would be excessively high, and on the other hand a lower voltage could be used without undue loss. In some cases, indeed, where a high voltage is used for small power, as for example on a branch circuit, an iron telegraph wire would have ample conductivity. In other cases an aluminum wire could be used to advantage, as an aluminum wire of the same conductivity as a copper wire has only about half the weight, and possesses greater mechanical strength in comparison to its weight.

It may also be noted that high-voltage transformers cannot be economically built for small output, as the insulation spaces required are so large. The cross-section of the copper is often not more than 10 or 20 per cent. of the area of the opening in the iron. The cost per kilowatt increases very rapidly when the size of transformer falls under a few hundred kilowatts.

Cables and Conduits.—The overhead transmission line has been considered, and its limitations are the insulating strength of the insulator and the losses through the intervening medium. In a cable or a conduit the insulation must be provided continuously instead of at points 100 feet apart. Rubber covered cables are made for 10,000 and 20,000 volts, but it is quite possible that it will not be commercially practicable to make cables for much higher voltages. The effect of continued electric stresses on the insulation of the cable, which is an unknown factor, may prove to be a very important one. A conduit composed of a pipe containing oil, in which the wires are separated by glass tubes has been proposed. Many mechanical difficulties arise in constructions of this kind; the cost is high and the action of continued high voltages on solids and liquids opens a field which is little known. A suitable insulation on the wires on high-voltage lines may enable higher voltages to be used than can be used with a bare wire.

Liquid air with its high insulating properties and the low temperature and consequent high conductivity which it would give to a conducting wire may enable us to use air insulation in a new way.

Difficulties and Precautions.—High voltages have been referred to in this paper with perhaps undue familiarity. Familiarity with high voltages is not one which breeds contempt. A voltage which can produce sparks several inches in length, which can be felt through several feet of air, which causes hissing sounds, which produces luminosity and which in a confined room generates strong odors of ozone, is one which creates profound respect. Dangers and difficulties accompany it and the highest intelligence, vigilance and excellence must be employed to avoid accident and ensure success. While ordinary types of construction do not seem to reach their limitations until some 50,000 volts is reached and pressures of this order have been and are in regular use, nevertheless they are not to be used indiscriminately or where they can be avoided. There are difficulties enough in handling 15,000 and 20,000 volts. As the pressure is raised the liabilities to trouble increase at an alarming rate. It is, however, a fact that these voltages have been and can be used, and also that no new or modified methods of transmission will be required before 50,000 or 60,000 volts can be employed for distances up to 150 or 200 miles.

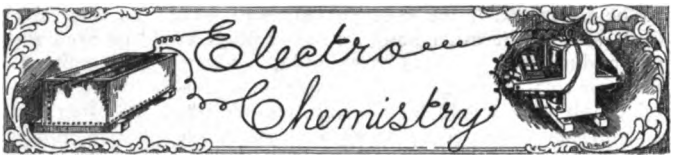
Transmission at Denver.

The work proposed by the Denver, Colo., Power & Irrigation Co. has been begun by building the reservoir on the Platte River, to cost about $1,000,000. The total outlay on the plant is estimated at $3,000,000, which is the company's capital stock. Mr. James E. Rhodes, of Denver, is president. The transmission will be 23 miles in length, and a capacity of 20,000 h. p. is spoken of, with ten generators of 1,500 k. w. output each, and transformers to correspond.

Bridge Construction by Electricity.

A bridge of 900 foot span at Budapest is being erected entirely by means of electrical machinery. The iron girders used as piles to keep the water back from the excavations for the shore pillars were driven in by an electric ram. The ram was a hammer rising 34 feet with a velocity of 12 feet per second. The soil out of the holes was raised by an electric windlass. The water was removed by seven centrifugal pumps working day and night. The 5-inch diameter pumps were driven by 10 h. p. motors, the 8-inch by a 16 h. p., and one 9-inch by a 20 h. p. motor.

Digitized by Google



Electro-Chemical Operations in Europe.

IN view of the growing importance of electro-chemical operations abroad, and the competition they are meeting on this side of the Atlantic, it will be of interest to review briefly some recent Continental practic. The details and illustrations, for which we are indebted to the "Electrical Review," of London, were prepared by Mr. John B. C. Kershaw, F. I. C., and show that electro-chemical operations in great Britain and France are being conducted on a large scale. Judging from the figures giving the output and cost of production the work must be commercially practicable, and yielding considerable profits.

THE DUMOULIN COPPER DEPOSITING PROCESS.

The Electrical Copper Company, of London and Widnes, have recently commenced at the latter place, which is rapidly becoming an important chemical centre, the manufacture of copper tubes and sheets by the Dumoulin process. In the ordinary electrolytic copper works, the deposit of copper obtained at the cathode is rough and coarsely crystalline, and further operations are requisite before this copper is obtained in the form in which it is ultimately used. In the Dumoulin and Elmore processes,

FIG. 1.—THE DUMOULIN COPPER DEPOSITING PROCESS, GENERATING MACHINERY, 800 H. P.

the copper is deposited upon a revolving mandrel, and is obtained in dense homogeneous form, only requiring passage through the annealing furnace to be ready for the market. These two processes differ merely in the method of obtaining dense smooth deposits while using currents of high density.

In the Elmore process, traveling agate burnishers are said to be used, whereas in the Dumoulin process, strips of sheep skin, from which the fat has been extracted by chemical treatment, hang over this upper surface of the mandrel, and are said to prevent any roughness in the deposit.

The Dumoulin process was invented by a chemist working in M. Dumoulin's laboratory in Paris in the year 1895, and the process is protected by British patents No. 16360, 1895; No. 9289, 1896; and Nos. 2709—2712, 1897. The British and foreign patent rights were purchased by "The Electrical Copper Company," capital $2,500,000, in May, 1896, and the works at Widnes were built in that year, and put into operation in the latter part of 1897. The experimental works at Brumoy were also purchased by the company, and samples of tubes and sheets are being produced at this place.

The plant at Widnes has hitherto been used only for the manufacture of sheet copper, but vats have been erected for the production of boiler tubes, and tubes are now being made at the Widnes works. These are situated on land which affords plenty of room for growth and expansion in the Ditton Roads, Widnes. Curiously the neighboring factory, also a recent addition to the number of metallurgical works in Widnes, is the electrolytic copper refinery of Messrs. McKechnie Bros.

The machinery and plant of "The Electrical Copper Company" is contained in several large and well ventilated brick buildings, each operation in the process being carried on in a separate building. The generating machinery, shown in Fig. 1, comprises five Peach engines direct coupled to five Crompton

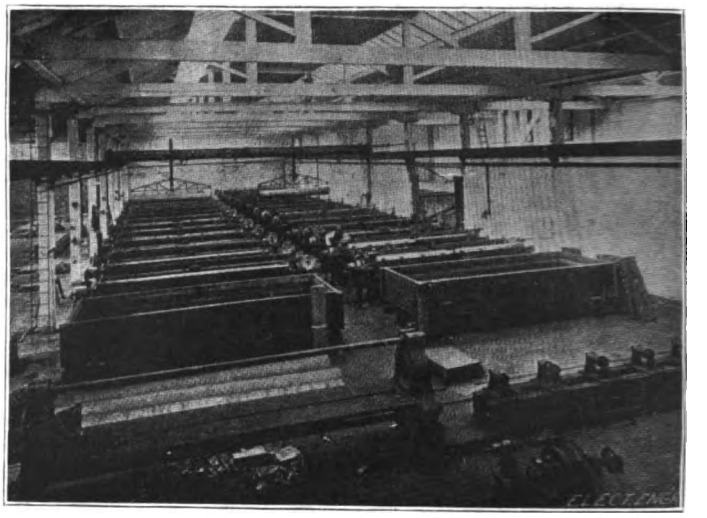


FIG. 2.—THE DEPOSITING VATS USED IN THE DUMOULIN COPPER DEPOSITING PROCESS.

dynamos. The engines run at 460 revolutions under a steam pressure of 150 pounds, each engine being of 160 i. h. p. The dynamos are direct current machines, and yield 1,300 amperes at 75 volts = 97.5 k. w. The engine house also contains one 40 h. p. horizontal slow-speed engine by which the machinery of the depositing vats and engineering shop is driven.

The copper depositing vats (Fig. 2) are contained in a second large building leading out of the engine house. Each vat is a shallow wooden trough, lined with lead and provided with supply and exit pipes for circulation of the copper sulphate electrolyte. This latter contains about 7 per cent. sulphuric acid, and 40 per cent. cupric sulphate.

During the passage of the electric current it is maintained in violent agitation by the revolutions of the mandrel. The mandrels are hollow cylinders of copper 12 feet long by 16 inches in diameter, capped at the ends, and mounted in insulated bearings. They are only half immersed in the electrolyte. The strips of sheep skin which give coherence and density to the deposit are

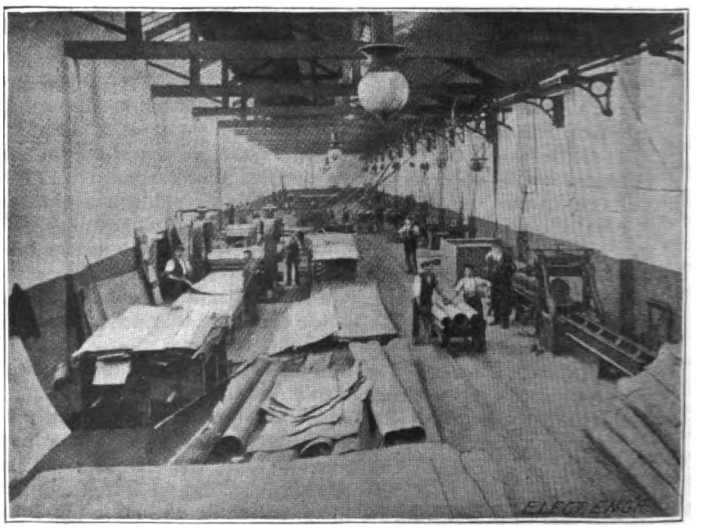
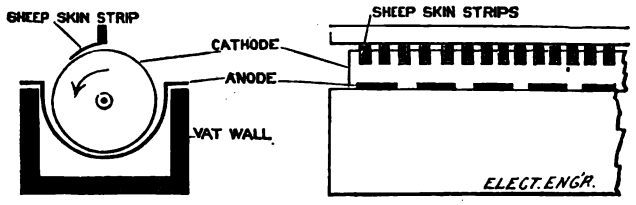


FIG. 3.—THE MACHINE SHOP, DUMOULIN COPPER DEPOSITING PROCESS.

held in a wooden frame, running from one end of the vat to the other above the mandrel. By means of an eccentric driven by a belt from the main shafting, a short longitudinal movement is communicated to this wooden bar and through it, to all the strips of prepared skin which it holds. Every inch of surface

Digitized by Google

of the deposit is thus constantly lightly rubbed by these strips of sheep skin. The anodes are thick plates of raw copper, roughly shaped to semi-circular form and provided with flanges, by which they are supported upon the vat walls. The two dia-



END SECTION SIDE ELEVATION.

FIG. 4.—DIAGRAM SHOWING THE DUMOULIN COPPER DEPOSITING PROCESS.

grams (Fig. 4) show the general arrangement of anodes and cathodes in the depositing vat.

A large number of these bent anode plates are placed side by side in the vat, until its length is quite occupied by them. The hollow cylinder with its capped ends is then lowered into its bearings, the electrolyte is run in, electrical contact is made and the deposition commences. The surface of the mandrel requires special treatment to prevent adhesion of the deposit.

After the deposit has "struck" all over the surface of the mandrel, the bar holding the strips of sheep skin is brought into the vertical position, and the deposition of copper proceeds without further attention.

The mandrel is revolved at a high speed, and the electrolyte is kept in rapid circulation during the whole period of deposition. Under normal working conditions it requires about 10 hours to deposit 44 pounds of copper in one vat, and the tube thus obtained is about 25 gauge in thickness, and weighs about 14 ounces to the square foot. The current density used is between 35 and 40 amperes per square foot of cathode area, whereas 20 amperes is the maximum now attained in electrolytic refineries with stationary cathodes, and formerly the current density used in these rarely exceeded 4 amperes. The gain in the time required to deposit large amounts of copper at the cathode is very marked, and the output of a plant could therefore be greatly increased by use of rotating cathodes. The voltage required is about 1.6 per vat, but this rises as the anodes are eaten away. When the deposit has attained the desired thickness, the mandrel, with its casing of pure copper, is bodily removed from the vat by a traveling electric crane, and is carried to a specially designed lathe, where a longitudinal cut is made from one end of the cylinder to the other, and the resulting sheet of electrolytic copper stripped off with ease. The whole operation does not occupy more than five minutes, and after applying a special composition to the surface of the mandrel, it is again ready for immersion in the electrolyte. The sheets of copper formed in this manner weigh about 44 pounds, and have a superficial area of 48 square feet. In the case of boiler tubes, the removal of the mandrel from the interior of the deposited copper tube will be effected by means of a hydraulic press. The depositing building at Widnes contains 30 vats similar to the above, and therefore when worked to its full capacity can produce 60 of the sheets per working day. The sheets of copper are carried from the depositing house to an adjoining building where they are annealed in a muffle furnace at a dull red heat, and then pickled in dilute sulphuric acid to remove the scale of oxide formed during the annealing process. Opening out of the depositing house is a large building in which the electrolyte of copper sulphate is filtered, cooled and pumped to the storage tanks, from which it flows by gravity through the depositing vats, back to the well in the same building. The filtration and cooling of the electrolyte after each passage through the depositing vats is found to be essential to the successful conduct of this process.

A large machine shop (Fig 3), a laboratory, and a store house for the finished copper complete the works.

Recent tests of the sheet copper produced by this process have shown a tensile strength of 18½—24 tons, and an elongation of 28—30 per cent.

THE ST. MICHEL ELECTROLYTIC CHLORATE WORKS.

As a result of the progress in electrical engineering science during the past fifteen years, the South Eastern Provinces of France, through which flow the tributaries of the Rhone, are becoming of great importance as manufacturing centres. Since 1890 a large number of important water power developments have taken place in the valleys of the Arc and of the Isére, and over 10,000 h. p. is already furnished by the former river to the manufactories of chlorate of potash, aluminum, and calcium carbide, situated along its banks. Of these manufactories, the chlorate works at St. Michel, 6¾ miles below Modâne, is one of the most interesting. This works is owned by the "Société d'Electrochimie," of Paris, and was built in 1894. Extensions to its present size were carried out in 1896. At this works (shown in Fig. 5), between 3,000 and 4,000 h. p. is utilized in the manufacture of chlorates of potassium and sodium by the Gall and Montlaur process. The power utilized in the works is derived from the River Arc at a point in the Maurienne Valley, 1½ miles above the works. The torrent in this valley at the time of the melting of the winter snows upon Mont Iséran is most impetuous, and in the past enormous damage has been done to the villages situated along its course. This rush of water at certain seasons of the year has, of course, been taken into consideration in designing the larger hydraulic installations which are now found in the valley.

The water which operates the turbines at the St. Michel Chlorate Works is conveyed from the intake by an underground channel, 1¼ miles in length, to a point 230 feet above the works. From this point, two pipe lines, 330 yards long and 47 inches in diameter, carry the water to the turbine house. The two pipe lines deliver 1,760 gallons of water per second, and this volume serves to operate 12—200 h. p., and 4—400 turbines. Each turbine is keyed direct to a Thury dynamo, and is run at a speed of 300 revolutions per minute. The larger dynamos (shown in Fig. 5) deliver 1,000 amperes at 200 volts, the smaller ones 500

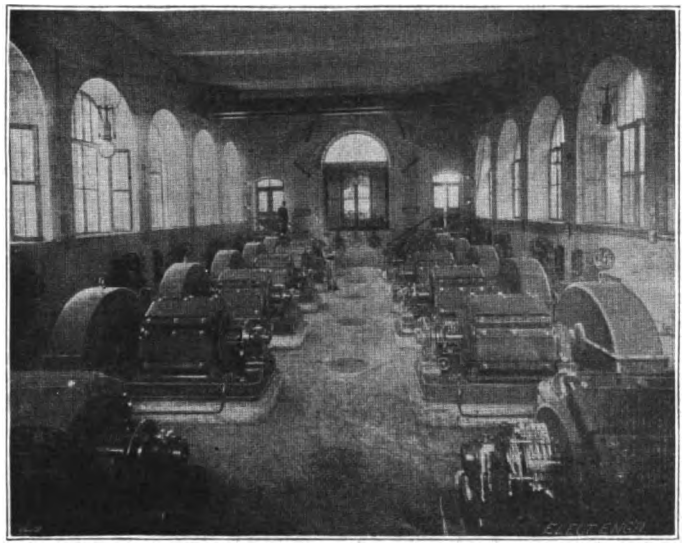


FIG. 5.—ST. MICHEL CHLORATE WORKS, GENERATING MACHINERY.

amperes at 200 volts. The total electrical energy available for the manufacture is therefore equal to 2,000 k. w.

The electrolytic process by which chlorate is made at this works, is in principle that described by Charles Watt in patent No. 13755 of the year 1851. A solution of an alkali metal chloride is electrolyzed between insoluble anodes, at a moderately high temperature, and the less soluble chlorate salt, formed by the reaction between the chlorine liberated at the anode and the caustic alkali formed at the cathode, is separated by crystallization.

Chemically, the manufacture is explained by the following equations:

$$6\,KCl = \underset{\text{Cathode.}}{6\,K} + \underset{\text{Anode.}}{6\,Cl.} \qquad (1)$$

$$6\,K + 3\,H_2O = 6\,KOH + H. \qquad (2)$$

$$\begin{cases} 6\,KOH + 6\,Cl = 3\,KOCl + 3\,KCl + 3\,H_2O. \\ 3\,KOCl = KClO_3 + 2\,KCl. \end{cases} \qquad (3)$$

(1) Represents the electrolytic decomposition of the chloride salt; (2) the instantaneous reaction between the alkali metal and the water at the cathode; and (3) the two stages of the chemical reaction which occur when chlorine and caustic alkali

Digitized by Google

are brought together in a hot solution. Messrs. Gall and Montlaur's process is, therefore, essentially the same as that patented by Watt in 1851, and their English patent, No. 4686, of 1887, chiefly refers to the apparatus used in carrying out the electrolysis. Rectangular vats lined with lead are used, each vat having a capacity of 11,000 gallons. The vats are insulated from the floor by oil cups. The anodes are of an alloy of platinum and iridium (90 per cent. platinum) which is found to stand the action of the chlorine better than pure platinum. They are only 1 mm. in thickness. The cathodes are of an iron-nickel alloy, and are covered with asbestos cloth in order to carry off the hydrogen liberated at their surface.

A very large volume of H (about 19,000 cubic feet) is produced for each ton of chlorate obtained, and this, carrying with it particles of the salt solution as it escapes, coats everything in the neighborhood of the electrolyzihg vats with a crust of salt. In the process as originally carried out, diaphragms of special construction were used, and the caustic alkali formed in the cathode chamber was carried by external pipes to the anode chamber where the reaction with the chlorine occurred. These are, however, believed to have been discarded in favor of open vats.

A current density of 465 amperes is said to be used. In this way the solution in the vats is maintained at a temperature of 45° C., and no external heating is requisite in order to promote the conversion of the hypochlorite of potassium or sodium into chlorate. The electrolyzed solution is run off from time to time, the chlorate is separated by crystallization, and the electrolyte is brought up to its original strength by addition of fresh chloride. When using potassium chloride as the starting points of the manufacture, the same electrolyte can be used for some weeks without complete renewal. The presence of metallic oxides in the vat solutions must be carefully avoided, since these instantaneously decompose KClO into KCl + O. The chlorate obtained from the vat liquor requires recrystallization before it is ready for the market.

The "Société d'Electrochimie," in addition to the works at St. Michel, possesses a chlorate factory at Vallorbes, in Switzerland, where 3,000 h. p. is utilized. The two works together are said to produce 1,800 tons chlorate per annum. The output per e. h. p. day at the commencement of the manufacture was only 1 kg. in place of the 2.69 kgs. demanded by theory, but M. Gall states that the yield has been materially increased since then.

COWPER-COLES PROCESS FOR REFRACTORY ORES.

One special feature of interest about the electro-deposition of the zinc from the sulphate solution by the Cowper-Coles process is the throwing down of the zinc on to aluminum plates which can be either stationary or caused to revolve, as shown in Fig. 6.

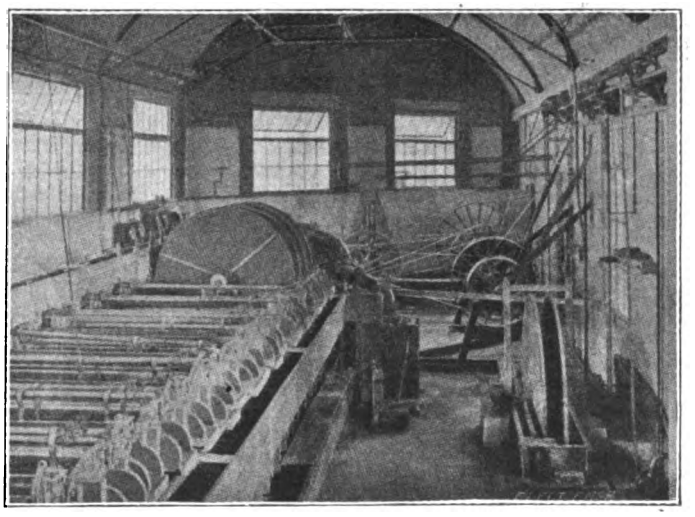


FIG. 6.—COWPER-COLES ELECTROLYTIC CYCLIC PROCESS, THROWING DOWN ZINC ON TO ALUMINUM.

The use of aluminum greatly facilitates the stripping of the zinc from the cathodes due to the formation of a loose film of oxide on the aluminum.

Hitherto the formation of zinc sponge has been nothing but a source of trouble and loss to those who have attempted to deposit zinc on a commercial scale, but Mr. Cowper-Coles has turned this difficulty to account. Zinc sponge is deposited on revolving discs, such as shown in Fig. 6, and is scraped off by means of adjustable wood scrapers and allowed to gravitate into a receiving box where it is drained. It is then dried, and forms

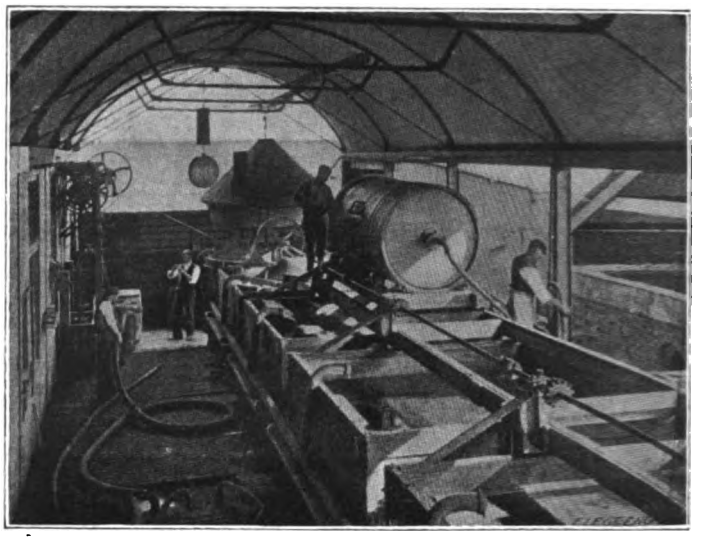


FIG. 7.—GENERAL VIEW OF LEACHING VATS, COWPER-COLES ELECTROLYTIC CYCLIC PROCESS.

a good substitute for what is commonly known as zinc dust, which is a greyish amorphous substance which is obtained as a sublimal product during the distillation of zinc from its ores.

This zinc dust is now largely used among other purposes in the Cowper-Coles regenerative electro-zincing process, to which we

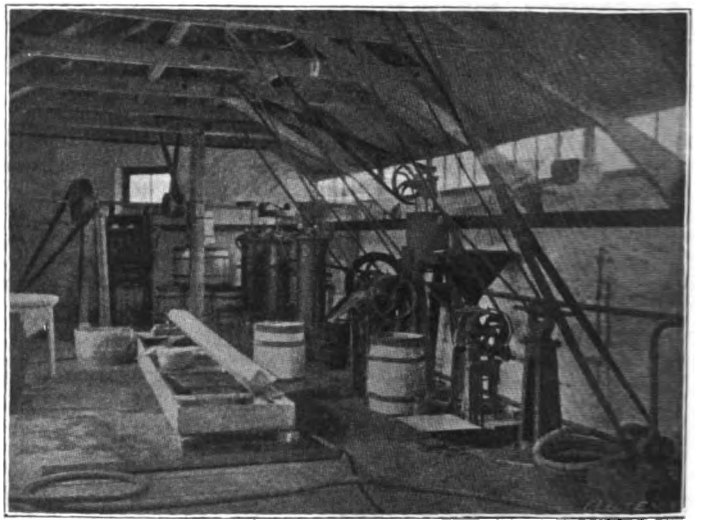


FIG. 8.—APPARATUS FOR PRODUCTION OF WHITE LEAD, COWPER-COLES ELECTROLYTIC CYCLIC PROCESS.

have also referred on former occasions. An analysis of zinc dust deposited by this method gave the following result:

Metallic zinc	54.88	per cent.
Oxygen (in combination)	12.55	"
Sulphuric anhydride SO_3	10.05	"
Silica	1.05	"
Copper oxide	0.80	"
Lead oxide	0.07	"
Alumina	1.20	"
Ferric oxide	0.60	"
Lime	0.45	"
Chlorine and carbonic acid	traces	
Moisture and organic matter	13.35	"
	100.00	per cent.

Digitized by Google

To insure the zinc being deposited in the form of zinc sponge a low current density is employed in conjunction with a weak solution.

The lead obtained by leaching out with a solution of caustic soda is also deposited on revolving discs, and the deposit scraped off from time to time. It is found that the lead thus obtained can be readily melted down without the addition of any reducing agent. The lead is found to be very pure and a sample gave on analysis the following result:

Copper	0.0800	per cent.
Cadmium	trace	
Bismuth	trace	
Antimony and tin	0.0004	"
Iron	0.0117	"
Nickel	trace	
Zinc	0.0150	"
Lead by difference	99.8929	"

Fig. 7 gives a general view of the leaching vats which are each capable of treating from 1½ to 2 tons at a time. A revolving barrel is provided for treating the finer portions of the ore, and is arranged to run over the vats on rails so that the contents can be discharged into any of the leaching vats.

Fig. 8 shows the apparatus used for the production of white lead from the sodium plumbate solution obtained by leaching the ore with caustic soda.

This building is also furnished with the apparatus for the deposition of the silver after it has been leached out from the ore with a weak solution of cyanide of potassium. The silver is thrown down on to silver sheets and the whole melted down. The white lead is precipitated with carbon dioxide, which is produced from calcium carbonate by passing the sulphurous acid gas given off from the roasting furnace through water; the sulphurous acid solution is then used for driving off the CO_2 from the calcium carbonate. The CO_2 and sulphurous acid are drawn off and are then passed through a sodium plumbate solution so as to precipitate the lead as lead sulphite, and the CO_2 thus purified is then passed into another cylinder where lead carbonate is precipitated.

Litharge is also made from the sodium plumbate solution by evaporating it at a temperature not exceeding 80° C. The evaporating pan used for this purpose is shown on the left-hand side of Fig. 8, any sodium silicate that mty be in solution having been previously precipitated as calcium silicate by the addition of calcium oxide.

COMMERCIAL CUBA. By W. J. Clark. New York: Chas. Scribner's Sons, 1898. Cloth. Large 8vo. Illus. Maps. Appendix. 514 pages. Price, $4.

The very fact that Cuba was so near yet so far, under Spanish rule, is demonstrated by the real necessity existing for this big, handsome volume, teeming with information on the island which can almost be seen from our own shores. There are a few of us who have spent more or less time in the West Indies and have therefore become familiar with much that Mr. Clark here sets down in so accurate and interesting a narrative; but for the American public in general the volume sums up data for which it is thirsting in these days of expansion. No matter how much or how little we like it, Cuba is now under our protection, and will remain so even when it has happily set up a working effective government of its own. For that reason alone, it becomes Americans to learn all they can, in order that we may deal judiciously with Cuban problems; but it is also obvious that our commercial intercourse with the island is destined, under any new political regimé, to an enormous increase, and here again the intrinsic value of this book is manifest.

Mr. Clark's title is sufficiently descriptive, but hardly does justice to the contents. It is true he does not set out to tell the whole tale of the island from its discovery, but a large amount of history is pleasantly interwoven in his treatment of the general subject. The author tells you how to meet the Cuban in society and in business, and the glimpses of Cuban life are admirable in their precision and useful suggestiveness. Other chapters deal with the population, the climate, the geography, travel, communication, law and police, fauna and flora, crops and products, the provinces, the cities, the various development, the prospects and the opportunities. There are other good books on the island, but "Clark's Cuba" will be the one to recommend. It is a business man's Baedeker, a moneyed man's Murray—and a great deal more.

Mr. Clark as a commercial diplomatist tries to say what he has to say with moderation and firmness, but the ugly facts of a brutal domination leak out, and one wonders how on earth the Cubans stood it as long as they did. Simply and plainly the story is told of the Cuban debt, for example, but it is impossible to read it without the feeling that to fix that debt on Cuba or the United States would be the rankest kind of a swindle. The way in which the cost of Spanish wars in Mexico, Florida and the Lord knows where, has been loaded on poor Cuba is enough to make a saint swear. Decent, honest figuring would show Spain indebted heavily to Cuba, but it is enough to note from Mr. Clark's book that while in Spain the burden of debt per capita is only $82, in Cuba it is $283 per capita! Does not that tell the story? There are some other significant facts in the book, although no emphasis is laid on them. Of course, we all know that Cubans had a mighty poor show in official matters. To be born a Cuban, even of Spanish parents, was enough to bar from employment and emolument. But even in the church, it appears that a Cuban was the under dog. No native Cuban has ever been Archbishop of Santiago or Bishop of Havana, and Cuban priests of lower rank are so rare you can hardly find them. Let that go, however. What shall we say of a country with a population of 1,500,000 in which there is not a single bank in which money can be placed at interest, nor a single, solitary bank for savings?

In his chapter on transportation and communication, Mr. Clark reveals the woeful lack of facilities, but we think the American invasion will soon change all that. The island needs electric roads, more steam roads, more steamships, more telegraph lines, more telephone systems, and it is going to enjoy them as quickly as capital and energy can replace the neglect and extortion of ages. It would appear from Mr. Clark's book that the United States, France and England have about $50,000,000 invested in the island. Under the new conditions it should soon reach easily three times that amount and pay a good return. Mr. Clark indicates many ways in which openings can be found.

A word of praise must be given to the get up of this timely and useful book, and to its pictures and maps, not forgetting its complete index and its list of several hundred business firms and their lines of trade and commerce.

The Fraser Electric Elevator.

In the last Journal of the Association of Engineering Societies, Mr. A. F. Brooke Ridley, member of the Technical Society of the Pacific Coast, describes and illustrates the Fraser Electric Elevator system. The author recounts the disadvantages to which other systems are subject, and claims that the Fraser elevator, recently invented and perfected, obviates nearly, if not quite, all of those disadvantages. In the Fraser elevator all gearing of any kind has been eliminated and the motors are never reversed; the brake is used only to hold the car, and for no other purpose. The speed of the elevator is controlled entirely by the strength of the field magnets, and it can be run at any speed at which it would be desirable to run an elevator. The apparatus is controlled entirely electrically when running both up and down; and the elevator can be brought to rest and its direction reversed, allowing only sufficient time to avoid discomfort to passengers. Its control is operated by making use of the small field current of the magnets, the main armature current being never broken under load. This obviates the most troublesome part of the mechanism usually employed. The operating mechanism consists merely of a field magnet controller and an armature resistance controller. The system is a modification of the well-known differential principle, as exemplified in the Weston differential chain block; with the difference that, instead of having two driving sheaves or pulleys of larger and smaller diameter run at the same speed, two separate pulleys of the same size are run at different speeds. In one system the difference of circumferential speed is obtained by having the pulleys of different diameters, in the other peripheral speed is changed by changing the relative number of revolutions. Two electric motors are used, connected by an endless transmission rope, each motor working independently; and by varying the speed of either armature the car can be made to go up or down.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Beta Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1882.]

Vol. XXVI. NEW YORK, DECEMBER 15, 1898. No. 554.

Pious Founders.

NEVER has a period seen larger gifts made to the public than the last forty or fifty years. A brilliant age of pious founders perhaps even now draws to its golden close. The next century may find the race of great individual benefactors extinct, their splendid liberality a melancholy tradition. Not because the needs and opportunities will then be fewer, but by reason of the insistent tendency to meet every general want from funds that have been gathered into the public treasury by taxation or the administration of the common domain. The mere act of personal giving presupposes an inadequacy of public resources, and there is a popular theory that if the artesian wells of individual generosity are shut down, the natural flow into the great impersonal reservoirs and pipes of the State will be able to quench freely every thirst. This is as it may be. Meantime, education in all its degrees, is furnishing many current notable examples of the substitution of State grants in the place of private benefaction. Visiting the numerous Western State universities one is struck by the absence of personal endowment in the shape of buildings, scholarships and prizes. The fact that the public chest—to which increasing dues must involuntarily be paid—can be drawn upon, has chilled the generous impulse of the man of large means, who, dimly conscious that to many he appears to exist only on sufferance, fears that, even if he continues to give, not a single mil would come off the tax levy on account of his largesse in aid of learning.

The time-honored disposition to seek out curious objects for endowment and to load the gift with weird observances, has not escaped sound criticism. Yet this wide, all-embracing range in the disposal of wealth remains one of the strongest arguments for its possession. If the foundation outrun its usefulness, there is but one minor almsgiving gone wrong, and not a whole ponderous system discovered crumbling away in hollowness, extravagance and decrepitude. Official pipes and reservoirs clog themselves; the springs of personal thought, sacrifice and endeavor, never choke up. Sweet are the uses of diversity, especially when the latest social emancipators propose a more effectual regimenting of mankind. Of late years, the imperative necessity of a deeper, broader education in the arts and sciences has taken such possession of men's minds that we tend even toward a slavery of facts, so pervaded is recent teaching with the idea of the paramount value of concrete data. An escape into the dust-pure ether of the humanities may again be welcome, just as a quarter of a century ago it gave joyous new life to study of all kinds to feed starved imaginations with seething milk direct from the warm breast of natural things.

To-day all of us have gone an engineering, with transit and level, pickaxe and test tube, microscope and voltmeter; but we should hardly have been able to do so had not the great modern institutions of technical culture been set up by private forethought and generosity. Typical in many ways, as the present writer had occasion to note in a recent magazine article, is the Stevens Institute of Technology, which perpetuates across a hundred and fifty years of tumultuous American life the undying memory of the exploits of a single great engineering family. Then there is Cornell, and away out on the Pacific Slope has sprung up the Leland Stanford Junior University—not forgetting many another in between, devoted to the mission of keeping bright the fires on the altar of knowledge.

For our rich Americans who do these noble things, the public reward is small, in the shape of honorable recognition; and perhaps it is just as well that way. But in England and her empire they order such matters differently, and thus it comes about that Queen Victoria is now bestowing the degree of knighthood upon Mr. W. C. McDonald for his splendid gifts of $1,500,000 to McGill University at Montreal. To Mr. McDonald and the not less generous Redpath family, old McGill owes the glorious renaissance that makes her the centre of Canadian culture; and it is, to us, peculiarly gratifying that so large a part of these later bequests has gone in the endowment of physical science. Indeed, there are few institutions in the United States that can compare with McGill University in modern equipment, and we do not know where, the whole world through, one could find more of the true spirit of research, uplift and higher education than at those dignified gray buildings planted majestically amid green meadows on the lower slopes of Mount Royal.

We venture to tender our congratulations to McGill University and to the new Canadian knight, Sir W. C. McDonald. There is a not unnatural prejudice in this country against titles, but knighthood is distinctly a personal honor; and as we said when Sir. W. Thomson was made Lord Kelvin, it is such honors appropriately bestowed that make the peerage respectable.

How to Develop Export Trade.

A FEW days ago the "Evening Post," of this city, preached an excellent homily on the right and wrong way of developing export trade. Here is its leading example of how not to do it: "A young American, who is spending the winter in Rome, had to stand up in a crowded trolley car the other day. He was in the front of the car, and he observed that a piece of machinery over the motorman's head bore the name of an American electric company. Upon it were long directions for the motorman, but they were in the English language. On the controller were also the words showing which way to turn in order to let on and shut off the power, but these words, too, were in English—'On' and 'off.' A firm in the United States, which is seeking and obtaining a market for its machinery in a country where the people read and speak Italian, offers instruction in the use of its appliances only in English." It seems to us that the young American who was smart enough to learn all this by observation, might have inquired a little further before giving our good friends of the "Post" ground for the untrue complaint that "Americans either will not learn the methods by which alone business can be successfully done or if they do learn, will not apply the lesson." We have read exactly the same complaints about English and other European efforts to get trade. Just now, English leaders of thought are urging their countrymen to acquire foreign languages in order to be able to do business better, and in Germany they are taking our machines and copying them with Chinese fidelity in order to compete with us. By all means let our merchants learn the best ways to capture trade, but let us be a little more cocksure than the "Post" is that "With rare exceptions * * * Americans refuse to do any of the obviously essential things."

As to this trolley car apparatus, did the young American find out whether it was ordered expressly for Italy? Does he know that it was made in America? Did he ascertain whether the motorman could read, anyhow? What difference would it make, if the man knew what to do, whether he could read the lettering or not? We have seen plenty of English and Scotch machinery with plain English signs on it in the hands of all kinds of foreigners, but "they got there just the same." It so happens that

Digitized by Google

a great deal of American electrical apparatus is now purchased for foreign use about which the manufacturer has no choice at all except to make it and sell it at a good price. One sale was reported not long ago of several hundred equipments, in a lump, to be scattered all over Europe, as subsequent orders might determine. How could the manufacturer label that batch? The cure for such a state of affairs would be for the American manufacturer to get closer to his real customer, without the middleman; but almost all export trade in manufactures appears to be done through middlemen and commission houses, and those concerns usually specify what they want and get it. Sometimes our American houses have their own factories abroad, and then their methods are about as native to the soil as anything of the kind we have ever seen. It may be that we are still a young people and don't know how to handle export trade or to elevate lower races or to take care of possessions and colonies, but Americans are not quite such backwoods blockheads as the "Post" has lately been intimating so freely. And if they once were, they are learning pretty rapidly to hold their own.

Consolidations and Cheaper Current.

SOME months ago—last summer, to be more precise—we stated that a movement was on foot to bring together the lighting and railway interests in the Greater New York, and even in other parts of the State. A couple of months back, the course of events in Brooklyn proved the truth of the prediction, and now comes the confirmation as to the Borough of Manhattan. The movement comes from the railway side, Mr. W. C. Whitney, of the Metropolitan Street Railway Co., and Mr. Brady, the associate of Governor Flower in similar transactions, being active in the matter. The absorbing corporation which will, it is said, acquire the Edison and other interests, is the New York Gas and Electric Light, Heat and Power Co.; and the Metropolitan Co. already has the conduits, even with cables in them, ready to deliver current in large quantities.

The public must look for more of these deals, which can and will justify themselves in one way, viz., the production and sale of current at the cheapest possible price. To-day that price is on a par with gas, and the end is by no means reached.

An "Electrified" Navy.

SUPPLEMENTARY to and confirmatory of our recent remarks on electricity in the navy, comes a letter from Mr. Gardiner C. Sims, now Chief Engineer, U. S. Navy, and stationed on the repair ship "Vulcan." The consummate experience and skill of this well known engineer gives weight to any remark, and we are glad to have permission to quote him as follows: "Our new cruisers, in fact all ships of the Navy, should in the main abandon all steam pumps, hoisting engines, anchor engines, steering engines, etc., together with steam pipes, thereby lessening the danger of their being carried away, resulting in loss of life and disaster to the ship. Duplicate electric plants forward and aft of the engine department should be installed; and motors used for the purpose required." This does but confirm the views that we quoted last week from several of the officers of the Santiago fleet, and Mr. Sims, in his letter to us enforces it by reference to what he saw of the terrific bombardment on July 1 of Santiago, Aguadores and the Spanish rifle pits. Mr. Sims also says on this subject, which he describes as of vital importance: "Later, in Guantanamo Bay, enduring the heat of the tropics, many of the officers' staterooms had a temperature of 105 degrees, due in a measure to the radiation of heat from the steam pipes. The sailors and others, poor fellows, could not sleep between decks, and were to be found slinging their hammocks anywhere that opportunity offered." This is convincing enough, but to us an even more curious fact is the one that Mr. Sims notes incidentally, viz., that the pumps of the "Texas" required extensive repairs, including eighty composition bushings for different connections! Now not only would electric motors have prevented this, but they would greatly lessen the extra weights that are so seriously objected to by the Navy Department.

While we are on the subject, mention should be made of a point brought out in Lieut. Hobson's story in the "Century" of the sinking of the "Merrimac." That was, of course, an engineering operation with a little seamanship thrown in. Possibly if Hobson had been more of a seaman, it might have been wholly successful; but that is neither here nor there. The point is that when the young constructor got his apparatus for exploding his torpedoes around the hull, he could not find a magneto or "electric machine," as he calls it, in the whole of that big fleet assembled off Santiago. He had to scrape up a battery and take chances on it, when a magneto would have been just the appliance to "do the trick." We are not finding fault with anybody, but rise to remark that it does strike us as most extraordinary that when Hobson wanted a magneto so badly, in the whole fleet there was none. Why? May we suggest that hereafter it be included in the electrical inventory of every U. S. ship?

Electric Traction in a Storm.

IT is very unusual for this part of the country to experience such a blinding snowstorm as swept down upon it on Saturday night, November 26, and this fact will go far to excuse and condone the breaking down of the various systems of traction. The under-running systems of trolley appear to have suffered the most from temporary paralysis and to have been slowest in recovering, due to the rapid filling up of the slots by the driving wet snow. The brilliant spectacles which we had personally the opportunity of watching on Lenox and Amsterdam avenues, between 11 and 12 p. m., will not soon be forgotten. The snow, as it fell and wedged, formed short circuits by which long sections of the slot were wreathed in blue electric flame of a most thrilling and spectacular nature, and it was remarkable that the resultant damage was so small, delay and loss of fares from inoperation being the chief damage. In many parts of this vicinity, equally with steam roads, the trolleys suffered and cars were abandoned or occupied all night involuntarily; but we have been wondering whether with closed conduits or surface contact methods, the troubles would have been so severe and prolonged. The present lesson is that eternal vigilance remains the price of continuous efficiency, for if the plows and sweepers had been kept going incessantly from the fall of the first flake, it may be fairly doubted whether a single line need have become stalled.

We may note incidentally and with pleasure the record made during the blizzard—for it was little else—by the electric automobiles. While hansoms and horse cabs were rapidly withdrawn from service or disabled, the electrics were in steady circulation all over the city, a perfect Godsend to lots of stranded people. Had there been several times as many of them, all would have found brisk employment, and they got around the snow-congested streets in great style. The only point that occurs to us by way of improvement would be a roughening of the tire in order to secure a better grip on slippery, icy roads. But the way in which their reserve power put them through the snow banks was "a caution." The electrics scored splendidly that memorable night.

Treadmill Generators.

AN Anglo-Indian technical journal reports that the subject of furnishing outpost stations with electric light and power is now under discussion at Calcutta, and that fuel and water being scarce in such regions of India, it is proposed to use the labor concentrated in certain jails, for turning treadmills hitched up to dynamos. The idea is not altogether new, for there is even one American manufacturer who has a bicycle dynamo plating outfit which we earnestly desire to bring to the attention of the Indian authorities at this juncture, it being obviously possible to use the bicycle part also for mere recreation. Now that India is to have an American Vicereine it would mitigate our horror at knowing that she was lit up on her frontier tours by human elecric light-makers, if the apparatus was built in this country. We have doubts as to the efficiency of human power plants, but the data on the subject is vague. Mr. C. F. Scott, in a recent affectionate tribute to the majesty of Niagara, says that if a man exerts a force of twenty pounds per stroke, on a pump, and works honestly eight hours per day, it would take ten times the population of the United States to return the water of the Falls from the base to the crest as fast as it falls. Now, if it takes ten Hindoo coolies to do the daily stint of one American, how many treadmillarians on the Indian frontier can furnish a decent light for the regimental mess?

Digitized by Google

TELEPHONY AND TELEGRAPHY

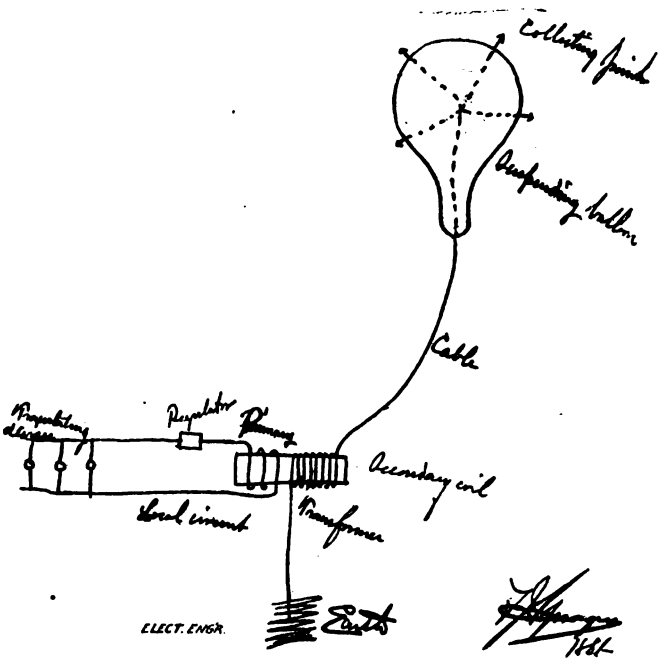
The Coherer in Warfare With a Word on Balloons.

BY FRANK J. SPRAGUE.

REFERRING to the various accounts of Mr. Tesla's recent proposals for the millennium, his project is nothing more nor less than the assembling together of apparatus which has already time and again been used or experimented with, and in the combination described is impracticable.

Briefly, it is the application of pilot motors supplied by local storage batteries, and actuated by relays, to the propelling, steering, etc., of a torpedo boat, the use of the pilot and the relay being such as is common in one form and another to most of our elevator and multiple unit railway work.

The closing of the circuit of each relay is through the operation of a Branly coherer energized by an electric wave of a given vibration or its harmonic. The construction and use of this coherer, of course, is well known, not only through the work of Branly, but Marconi and others. One of the fatal defects in the method is that any ship could set in operation automatic means for getting vibrations of any required strength and varying frequency which would be more effective upon the apparatus on the torpedo boat when approaching near it than the impulse



SPRAGUE PLAN OF 1881.

from the shore would be, and by having variable waves through a wide range continuously and rapidly excited, the form of control proposed would be made utterly useless. The project may be fairly termed visionary.

One method of preventing this interference could possibly be adopted—that is, the placing of two or more coherers in series with each other and the relay in each circuit, each adjusted to respond to a different tone or harmonic, and requiring the simultaneous creation of the two or more waves, which combination would be hard to duplicate from another source, and in that way a control of a more or less positive character could be effected. The coherer is, however, so delicate an apparatus that its reliability for this purpose may be doubted.

In this connection I may point out what was proposed a good many years ago by me, and which anticipates in idea much that has since followed in more than one direction.

In 1881 I was a midshipman on board the "Minnesota," a U. S. training ship at Newport, at a time when the late Moses G. Farmer was the electrician of the Torpedo Station, and Lieutenant Commander Robert Caldwell, since deceased, was head of the Torpedo Department. My tastes being then, as now, more electrical than naval, I spent all my spare time at the station, where I was in frequent touch with Mr. Farmer and Mr. Caldwell, and I was engaged in the construction of a double coil motor or dynamo with series parallel switch arrangement. One day in a discussion with Caldwell, the latter said that while he did not believe in perpetual motion as ordinarily understood, he did believe that the time would come when we would be able to make use of the lack of equilibrium or the differences of potential existing between various parts of the earth, or between the earth and the atmosphere.

This idea took strong hold on me, and while thinking of the possibilities, my mind turned to a large and powerful Ruhmkorff coil of the ordinary type, fine secondary and coarse primary, with a circuit interrupter in the latter, and also to Franklin's experiments with his kite, and I reasoned as follows: If by making and breaking a circuit of some volume but of low potential in the primary of the coil it is possible to get a high potential interrupted current in the secondary, why is it not possible to reverse this action, and, by producing an interrupted, small current of high potential in the secondary, get a low potential, large current in the primary; and in this event, why is it not possible to connect up the low potential primary, wound on an iron wire core, to a circuit having translating devices in it with some means for regulation, and to ground one terminal of the secondary, attaching the other terminal to a number of metallic points maintained high in the air by a balloon or otherwise, as per the rough sketch attached?

At that time, it will be remembered, the alternating character of lightning discharge was not fully realized, and I looked upon it simply as a current of interrupted character. The possibility of a breakdown of the apparatus of course occurred to me, but I reasoned that with a sufficient number of points there would be a succession of frequent discharges at times, at a moderately high potential, and not any great single discharge. The idea also occurred of the possibility of using two or more of these coils with balloon attachments, and introduce some means for making the primaries work together. This crude idea I think may be fairly called the precedent of the modern transformer system, as well as anticipatory of something of the widely heralded "new" invention.

Telegraphy in Cuba and Porto Rico.

A SPECIAL dispatch from Washington says: The War Department is having great difficulty in obtaining efficient telegraph operators to operate the military lines under the control of the United States Government in Cuba. A large number of operators were enlisted in the Volunteer Signal Corps, but these men were in most cases released from regular positions with the promise that at the end of the war they should be restored to their places. The telegraph companies have objected to keeping these offers open now that peace has practically been declared, and a large number of telegraph operators in the Signal Corps have been mustered out for this reason. The War Department now has about 300 miles of telegraph lines under its control in Cuba, and it is expected that many hundreds of miles now in use by the Spanish authorities will be controlled by this Government when formal possession of the island is taken.

Colonel Dunwoody, of the Signal Corps, made an arrangement to meet a number of telegraph operators at the headquarters of the Signal Corps in the War Department building, but the operators, upon learning that if they went to Cuba they would be obliged to enlist as privates in the Signal Corps at the privates' pay of about $17 a month, refused to consider the Government's offer. There is an imperative need for telegraph operators in Cuba at once, and this need will increase rather than diminish as new lines are acquired. It is probable that the Government will have to resort to the expedient of employing civilian operators at regular rates of pay.

Another Washington dispatch of Dec. 8 says: The situation in Porto Rico promises to force on this Government for a time at least the experiment of federal ownership of telegraph and telephone lines. The War Department now controls all lines in Porto Rico and in the evacuated sections of Cuba. The latter, however, is looked upon as merely transient. In both places

Digitized by Google

the lines are being repaired and the Government is handling commercial messages after Government matter. The Signal Service in charge of this work says it is too soon to draw conclusions as to the expense of the service, as the cost, for maintenance and long-delayed repairs, is just now more than the income from the lines. But in six months from the 1st of January the Signal Service expects to be able to furnish some interesting data as to the profit in the insular-wire service.

The military occupation of the lines will naturally continue till the establishment of a civil government, and considerable interest is expressed as to how the management of the lines will be disposed of eventually or whether it will be permanently retained by the Government. The Signal Service reports the commercial business on the island wires light at present, owing to disturbed business conditions, but what there is of it is expeditiously and satisfactorily handled by the Government men.

Telephones are being substituted for telegraph instruments on most of the purely military lines, but the work of reconstruction in Cuba is very slow as it is at least ten years behind hand in repairs. The latest military line under construction is from Nuevitas to Santa Cruz, fifty miles.

Claims for Cutting Cuban Cables.

A special dispatch from London of Nov. 23 says: At the meeting of the Cuba Submarine Telegraph Company to-day the chairman, Mr. C. W. Parish, referring to the cutting of the cables off the Province of Santiago de Cuba by the Americans, said he had requested the assistance of the Foreign Office to obtain compensation from the United States. The Foreign Office, he added, had promised to do its utmost to assist the company, but, it was pointed out, it was doubtful if the claim could be admitted.

ELECTRIC LIGHTING.

The Mechanical Plant of a Modern Commercial Building.—II.[1]

BY WILLIAM H. BRYAN, St. Louis, Mo.
(Member of the Society.)

THE next question was as to type of boiler—whether of the water-tube or of the ordinary horizontal return tubular variety. The writer's experience had led to the conclusion that the water-tube boiler possesses three important advantages:

1st. Large capacity in small space.

2d. Large capacity in single units.

3d. Safety—particularly with the high pressures required for modern steam plants of high efficiency.

On the other hand, the ordinary boiler has the advantage of lower first cost—particularly in the smaller units; simplicity, and ease of being cared for.

In the above comparison, no preference is given to either type of boiler on the score of efficiency; it being the opinion of the author that there is no material difference, assuming that both boilers are designed, constructed, operated and maintained with equal intelligence. It is undoubtedly true that water-tube boilers are actually showing better fuel economy all over the country than the average ordinary boilers, but the latter installations are usually small, and rarely receive the skilled attention in their construction and operation given the water-tube boiler.

A consideration of the requirements of the present plant clearly "indicated" the adoption of the water-tube boiler, and the specifications were drawn accordingly.

The specifications for Section A covered the boilers erected in place, with all the usual fixtures and fittings, brickwork, and smoke flue leading to chimney.

The general scheme of the boiler room as originally outlined and as actually adopted, is shown in Fig 1. The boilers were designed to burn low-grade slack and nut coal from Southern Illinois, and to use St. Louis hydrant water. The boilers and furnaces were to have a combined efficiency of at least 70 per cent. of the calorific value of the fuel when operating at anywhere between their rated capacity and 20 per cent. above.

The contractor was to furnish and attach to each boiler a smokeless furnace, equivalent in capacity, efficiency, and smokelessness to the down-draught with lower grate. This requirement was inserted for two reasons: First, this type of furnace unquestionably improves the fuel efficiency of the boilers; and, second, the plant being located in the heart of the city, it was desired to avoid any smoke nuisance, although the city smoke ordinance has been declared invalid by the Supreme Court of the State.

The chimney (Fig. 1) was included in the building contract. It was located inside a square brick shaft, and was made of riveted steel ¼ inch thick, resting on a substantial cast-iron

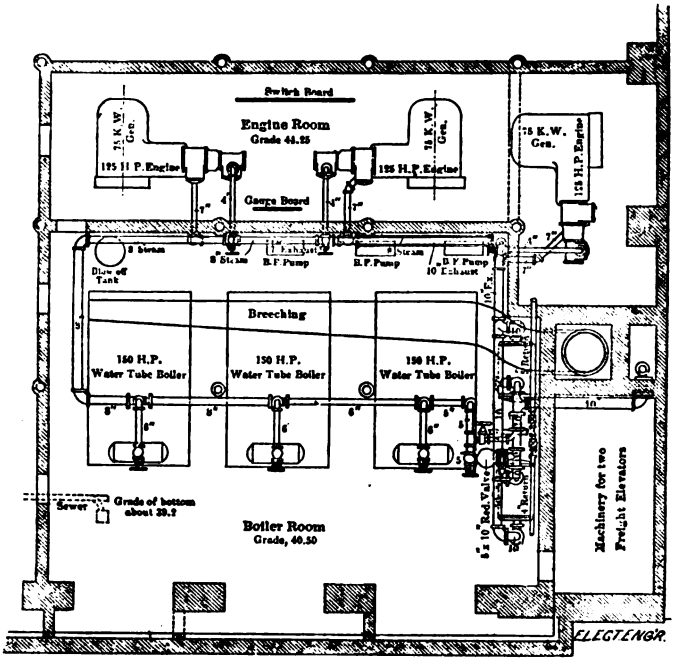


FIG. 1.

foot plate. It was lined its entire length with firebrick. Its dimensions were 48 inches internal diameter by about 135 feet high, above floor level of boiler room. It would ordinarily be rated at about 400 horse power. The dimensions were decided upon when the building was begun, before any of the computations as to actual steam requirements had been made. It was assumed that only two boilers would ever be operated at one time, and that the stack could be overworked in emergencies, as experience has shown to be possible.

SECTION A.—HORIZONTAL RETURN TUBULAR BOILERS.

Thinking that the cost of the water-tube boilers might be greater than the owners cared to invest, it was decided to ask for alternate proposals on horizontal return tubular boilers of as nearly the same capacity as possible. The plant was divided into four units, three of which were to be able to do as much work as two of the water-tube boilers. The size best suited to the space available was 66 inches in diameter by 20 feet long, with sixty-four 4-inch tubes 20 feet long. At 12 square feet heating surface per horse power, these boilers would be rated at 131 horse power each, or 393 for three, and 524 for the entire plant.

The chief advantage of boilers of this type is supposed to be lower first cost, although this disappears, to some extent, on large boilers built for high pressures. The belief is common that such boilers cost less for repairs, and are more easily operated and cleaned, than the water-tube boiler. While these claims have been proven in some cases, the opposite has also been shown to be true in other instances, so that the truth of either proposition cannot be said to have been established as yet.

SECTION B.—THE ELEVATOR SYSTEM.

This division presented the most complicated problem encountered, and one on which there was the widest difference of opinion among interested parties. Steam elevators had been used by the tenants in the old building with entire satisfaction.

[1]Abstract of paper read at the Nineteeth Annual Meeting of the A. S. M. E., New York, Dec., 1898.

Digitized by Google

The architects had recently installed in a large system of warehouses a modern high-pressure hydraulic plant, which had displaced a system of steam elevators, and had made an enormous fuel saving. The engineers had devoted considerable time to the study of modern electrical elevators, and recognized that they were destined to come into extensive use. They were not, however, fully convinced that this was the proper system to adopt in the present instance, and were fully aware of the advantages of the other two types. It was decided, therefore, to so word the specifications that comparative bids would be received on all three types.

Some interesting data was secured from the tenants' old plant. Tests were made on their single passenger and three freight elevators on an average busy day. It was found that the passenger elevator was in actual motion 47 per cent. of the time, and the freight elevators 35 per cent. of the time. To determine the loading of the passenger elevators, the 6 foot by 6 foot car was filled with people who happened to be conducting business in the store at the time. Eighteen were crowded into the car. Estimating their weight at 2,700 pounds, the loading was 75 pounds per square foot, which would seem to be a safe figure for passenger cars.

The tenants indicated their elevator requirements as follows: There were to be two passenger elevators, located in the southeast corner of the building, each to have a safe carrying capacity of 2,500 pounds of live load at a maximum speed of 300 feet per minute. These elevators were to be operated by conductors and to run between basement and top floor, stopping at all floors. The other six elevators were to carry freight only. The two southwest elevators were to be operated by conductors and to have a capacity of 3,500 pounds at a speed of 225 feet, operating from basement to top floor, stopping at all floors. Their duties were to carry sold goods up to the top floor to be packed for shipment. The northwest and northeast elevators were to carry 4,000 pounds at 150 feet. The northeast elevators were to be operated by porters, to carry packed goods in both directions, stopping at all floors. The northwest elevators were to carry packed goods from the eighth floor to shipping room. They did not run to the basement, nor stop at intermediate floors, and were operated without attendants on the cars. The dumbwaiter was to be of the electrical type, designed to carry 200 pounds 100 feet per minute. The contractor was to provide ornamental metallic gates on each floor for passenger elevator shafts. Separate proposals were invited for safety gates at the freight elevator doorways on all floors.

The original specifications were written to cover hydraulic elevators, alternative proposals being invited on electric and steam machines capable of doing the same work. Contractor was to furnish the machinery complete ready for service, and allow $300 for each passenger car. The travel of the northwest elevator was about 87 feet and that of all others, 105 feet. Working steam pressure, 120 pounds. The water pressure for the hydraulics was not to exceed 750 pounds at the pumps. Guide posts, of steel. Cables to be of such number, dimensions, and strength, that in case half of them should fail simultaneously, the remaining half would carry the maximum load, with a factor of safety of 4. Counterbalancing was to be employed as far as possible. Complete safety devices were to be supplied, preventing excessive speeds in either direction, automatic stops at end of travel, and other features, such as slack cable stops, buffers, grips, etc. The pumping engines were to be two in number, each sufficiently large to handle the plant at a piston speed not exceeding 100 feet per minute, with the aid of the accumulator. Both pumps were to be of the horizontal direct-acting duplex type with compound steam cylinders, and outside packed water plungers. One was to be of the high duty pattern, having a water rate of not over 28 pounds per indicated horse power hour. The other pump was to be of the ordinary duplex pattern, with a water rate not exceeding 60 pounds per indicated horse power hour. There was to be a weighted mechanical accumulator for the hydraulic system of such capacity that with six elevators operating continuously in the same direction, stopping only at the top and bottom floors, and one pump in operation at not exceeding 100 feet piston speed, the elevators would do the specified service. The discharge tank was to be located in the attic. Contractor was to furnish and erect all necessary apparatus, and do all water piping. He was to furnish the lubricating apparatus, paint the plant, and submit it to such tests as the engineers might require.

The determining of the horse power required to operate the elevator plant presented many difficulties. There was at that time—and still is—a lack of authentic data as to elevator performance covering wide ranges of service, and it is still impossible to make such computations accurately. Extreme accuracy, however, is not necessary, in view of the fact that it is impossible to predict what the average loads and percentages of time in operation will actually be in a prospective plant.

The problem was finally solved for hydraulic elevators in the following manner: The average net horse power required by each freight elevator lifting its full live load was 20 horse power, and for each passenger elevator, 22½ horse power. There were six of the former in operation one-third of the time, but as they use no power coming down, the average work done was 20 net horse power. The two passenger elevators were assumed to be in operation one-half of the time, and their requirements were, therefore, 11¼; a total for the eight machines of 31¼ net average horse power. Assuming an average efficiency of 55 per cent. from water end of the pump to work done, the horse power of water end of the pump would be 56. On the basis of a mechanical efficiency of 75 per cent. for the pump, the indicated horse power of the steam end is 75, the figure already used in determining the boiler capacity.

The electric elevators, however, presented greater complications. Tests have shown that where drum machines are counterbalanced to half the average load, and where the same total load is carried both up and down, the net work done is simply that necessary to overcome friction, plus an allowance to cover the "surge" of energy required at each start. A study of this subject, in connection with records of tests made on similar plants, indicated that when operated under favorable conditions of loads, counterbalancing, frequency of stops, etc., these elevators should have an efficiency, running in both directions, about as follows:

The two passenger elevators.....3½ k. w. hours per car mile.
The two southwest freight elevators.4¼ " " " " "
The four north freight elevators.....4½ " " " " "

On this basis, the electrical horse power required to keep each elevator in motion was found to be 4⅔, 5⅔, and 6, respectively, per car mile. The speeds specified, however, were 3.4, 2.55, and 1.7 miles per hour, respectively, on which basis 15.9, 14.45 and 10.2 elevator horse power were required. Assuming that the passenger elevators might be in motion one-half the time, and the freights one-third, and multiplying by the number of elevators, the power consumed is found to be 15.9, 9.6, and 13.6 elevator horse power, respectively; a total of 40, in round numbers. In view of the fact however, that ideal conditions of loading and counterbalancing would never be reached, and also that uncertainty existed as to the actual number of stops per trip, and percentage of time which the elevators would be in operation, and in order to avoid any appearance of partiality to the electric installation, it was thought wise to increase this allowance by 50 per cent., and to call the total 60 electrical horse power at switchboard. Assuming a combined engine and dynamo efficiency of 80 per cent., the average indicated horsepower at cylinders of dynamo engines is 75, as already stated.

In computing the horse power required to drive steam elevators, it was presumed that they would be run by direct connected steam engines in the ordinary manner. The machines are almost identical with the electric elevator of the drum type operated by worm gear, the direct-connected steam engine taking the place of the distant steam engine generating current through a dynamo, and transmitting it for use in a direct-connected electrical motor. The work done by the elevator proper is the same in both cases. Assuming the efficiency of the motor on the electric elevator to be 83 per cent., the net power consumed by the elevator mechanism itself is 50 horse power. Taking the mechanical efficiency of the steam elevator engines at 75 per cent., we arrive at the figure 67 above referred to.

The clause in the specifications providing for alternative bids on electrical elevators stipulated that the elevators were to be of the same general character as the hydraulic, modifying the design only in so far as necessitated by electrical driving. The purchaser agreed to supply electrical current at 220 volts at the switchboard. The contractor was to do all wiring from that point to elevators. Elevators to be of the single or double worm type, with steel worm and gun metal gear. The motor was to have an automatic starting device to give the car an easy start independent of the operator and cable, returning to

Digitized by Google

the starting point automatically in case of interruption of the current. When starting from rest to full speed within five seconds, the starting current was not to exceed the operating current at full speed by more than 50 per cent. The purchaser was to provide a third electrical generating unit of 75 k. w. capacity in case electric elevators were adopted. The plant to be so designed as to be capable of operating in multiple with the lighting system without noticeable interference with the steadiness of the electric lights.

The alternate proposals asked for on steam elevators were to comply with the same general conditions as before, except that the elevators were to be driven by direct-connected steam engines of the duplex double-acting vertical type. Separate proposals were invited on an ash-hoist to have a platform of about 60 inches by 23 inches; capacity, 1,000 pounds; speed, 50 feet; travel, about 20 feet.

SECTION C—DYNAMOS AND SWITCHBOARD.

The contractor for Section C was to furnish and erect the generators and switchboard, with connections between same, as located in Fig. 1. Proposals were to state the commercial efficiency of the generators at ¼, ½, ¾, and full load, subject to test after the machines were installed. A study of the purchaser's needs showed that they could be best met by a combination of arc and incandescent lamps. A preliminary location of arc and incandescent lamps was agreed upon, showing approximately 200 arc and 600 incandescent lamps. In addition, there were three motors driving fans in basement, and an allowance was also made for small fan motors throughout the house, and about 1 per cent. for drop in the wiring. These were summarized as follows:

200 arcs at 2½ amperes, and 220 volts, or 550 watts	= 110,000	watts.
600 —220-volt 16 candle power incandescents at 60 watts	= 36,000	"
For motors, drop, etc.	4,000	"
Total	150,000	"

It was decided that this load could be best handled by two 72 kilowatt generators. As such machines can run at considerable overloads, two-thirds of the total lights could be handled with one machine out of service. Three 50 kilowatt machines would have been better, but would have cost more.

The selection of dynamos whose rated capacity was equivalent to the total number of lights connected, may be criticized, in view of the fact that ordinarily the maximum number of lights burned at one time—even for short intervals—is less than the number connected, and that the generators can be overworked considerably for short periods. The anticipated load factor, however, was large, and some margin for growth was necessary. No special or reserve machine being provided, it was not desired to cripple the plant more than absolutely necessary when one machine might be shut down on account of accident, or for repairs.

One hundred and fifty kilowatts at the switchboard is equivalent to 200 electrical horse power. Assuming a combined efficiency of engine and dynamo unit of 80 per cent., the indicated horse power in the steam cylinders is 250, as already stated in estimating boiler capacity.

The question might be asked why the maximum load was taken for the boiler horse power, when the average load would be much less, and the entire number of lights would probably never be burned at one time. As explained above, the work done in this building was of such a nature that what is known as the "load factor," or ratio between the maximum number of lights operated at one time, and the total number connected would be large, and it would sometimes happen that every light might be burning. Furthermore, experience has shown that more lights and motors are added as business increases and the necessity for them develops, so that some margin for growth must be allowed.

A departure from established practice was made in adopting a voltage of 220, instead of 110. This was done for three reasons:

First, it was desirable to have an outside connection from a central station for use in the event of any serious accident to the plant. No central station, however, furnished direct current for power at 110 volts, but two convenient stations offered such service at 220 volts, both being from 220 to 440 direct-current three-wire systems.

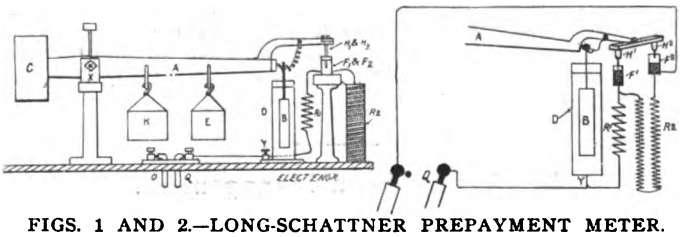
Second, it was believed that the electric motors would give better satisfaction at this voltage, and stopping and starting them would have less effect on the lights, as it was intended to run the entire light and power service from the same electrical apparatus.

Third, the distances covered being quite large for an isolated plant, both the investment in copper and the "drop," or percentage of loss in wiring system, were materially reduced.

It is true that the 220-volt incandescent lamp is not as efficient as the 110, and that it costs more, thus increasing the cost both of fuel and of lamp renewals. The 110-volt 16 candle power lamp ordinarily used, consumes about 55 watts, and the 220 volt, about 60. This means 9 per cent. more generating capacity and fuel burned. The 16 candle power 220-volt lamp costs from 23 cents to 25 cents each, and the 110-volt, 18 cents to 20 cents. This inferiority is largely due to the fact that the number of 220-volt lamps in use is still small. The efficiency is improving, and the price falling, as the demand increases, and it is believed they will, in the not distant future, approximate closely to the 110-volt lamp. In the present case, it was believed that the advantages of the 220-volt system overbalanced the objections named.

The Long-Schattner Prepayment Meter.

ONE of the principal, and we may say necessary, requirements of a prepayment meter is its extreme simplicity and cheapness, in preference to great accuracy over a large range and long running power. The sums of money collected are generally small and the installations are not of sufficient size to warrant the purchase of a complicated and expensive instrument. Besides, the visits of inspectors are so frequent that long-running meters are not required. These considerations, however, do not in the least alter the general opinion of engineers that a mechanical meter is to be preferred for such a class of work, to one dependent on electrolytic action, even if the price is in favor of the latter. It is true that the mechanical simplicity, freedom from frictional errors and capacity of accounting for the smallest currents are very great recommendations for the chemical meters, but they have certain disadvantages. There is usually a serious fall of potential in the cells, and they are liable to corrosion and decay. These, however, are somewhat kept in check or eliminated by high voltages and care. A meter of this class, which in principle somewhat resembles the old Edison meter, has, we



FIGS. 1 AND 2.—LONG-SCHATTNER PREPAYMENT METER.

understand, lately met with considerable success at Norwich, England. It is the Long-Schattner meter, shown in perspective in Fig. 3 and diagrammatically in Figs. 1 and 2, the latter being a plan of connections. Referring to the figures, A is a lever pivoted at X. At the far end of the lever is suspended a copper plate B, which is immersed in a solution of copper sulphate. The box, D, is also of copper, and forms the cathode. C is a weight to balance the other side of the lever. K and E are cups to hold respectively the coins and standard weights with which the collector replaces the coins he removes. F_1 and F_2 are mercury cups, F_1, the front one, being filled with mercury; F_2, the back one, being half filled with mercury and filled up with creosote oil. H_1 and H_2 are contact pieces forming a bridge across the mercury cups, which bridge is fixed on the lever. R_1 is a main resistance, across which the voltmeter goes as a shunt, and R_2 is a large resistance going from one mercury cup to the other. The purpose of this is to prevent total extinction of the light when the switch is open, though there will not be sufficient light to serve any useful purpose until the addition of more money to the scale-pan closes the contact, F_2, once more. It also prevents sparking at the mercury surface, since the circuit is never altogether opened. The electrolytic cell is a

Digitized by Google

shunt to the resistance, R_1, and provided the usual troubles concerning uniformity of temperature and resistance are duly overcome, the loss of weight in the anode plate is strictly proportional to the quantity of electricity that passes, and therefore, with uniform pressure of supply, to the electrical energy used.

The customer gains nothing by delay in putting in another coin, since he has to pay for the current passing to keep his lamps burning low; rather he loses by such delay, for the light is during that time by no means proportionate to the energy producing it. The drop across the meter is, at full load, only 0.2 volt, or one-tenth of that across the terminals of a gas-electrolytic meter. By the arrangement that the current enters at the top of the plate and leaves at the bottom of the containing box a uniform deposit is obtained—a matter of some importance to

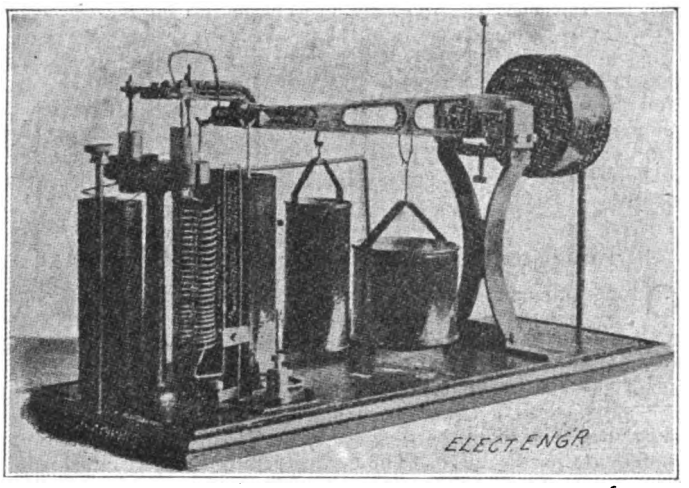


FIG. 3.—LONG-SCHATTNER METER.

the accuracy of the meter, since the resistance of the electrolyte is thereby kept constant. The meter registers with any, the smallest, current that flows through it, and when correct at any load, is so at all loads. The electrolyte is a copper sulphate solution of 1.115 specific gravity, in a 1 per cent. mixture of sulphuric acid and water. The plate and box will last for 700 units, after which they must be replaced by a fresh plate and box at a cost of about $1.20. A weight fixed vertically above the axis of the lever raises the centre of gravity and secures a quick break as soon as the counterpoise overcomes the coins and copper plate, but the movement is not sufficient to prevent the weight even of so small a coin as a three-penny bit from overbalancing the lever and making fresh contact.

Brooklyn Edison Management.

The management of the Kings County Electric Light & Power Company has decided, says the Brooklyn "Eagle," to retain General Supt. W. S. Bartow, of the Edison Electric Illuminating Company, as general manager of the recently consolidated company. Mr. Barstow has been for many years connected with the Edison Company, and has an enviable record for his thorough knowledge of the electrical business as well as for executive ability of a high order. E. F. Peck, who has been the secretary of the Kings County Company, has been appointed assistant general superintendent. Mr. Peck has been interested in electric matters in Brooklyn for years, and has been connected with the Citizen, Edison and Kings County companies. No other changes in the personnel of the management will be made for some weeks and not until the report now being prepared by A. M. Young has been presented and acted on by the board of directors.

ELEC. MOTOR AND EQUIP. CO. has been incorporated in New Jersey, with headquarters at 781 Broadway, Newark. Its capital stock is $100,000, and the organizers are A. J. Miller, J. G. Ward, Jr., and F. G. Agens, Jr., all of Newark. The objects are to deal in, make, repair, etc., electric motors, apparatus, etc.

Conference of the National Municipal League.

DURING the first week of the month a conference of the National Municipal League was held at Indianapolis, when a number of clubs were represented, and papers read by men prominent in city reform matters. Mr. Charles Richardson, of Philadelphia, said in regard to the "model city charter" proposed by the committee of the league: "It is unanimous in the opinion that the city should be free to choose for itself between the policy of leasing its franchises or of retaining and operating them for its own benefit in any given case, and should be clothed with ample power for acquiring and managing public properties. The committee regards the possession of this power as essential to protect the interests of the city, and as supplying an added motive for the watchful and intelligent participation of the people in the affairs of their local government.

"The committee is also convinced that it has been demonstrated by abundant experience that, in the interest of the public, when a city grants a franchise to a private corporation, association or individual, the term of such grant should be limited to a definite period, not exceeding twenty-one years; in addition to any other form of compensation, the grantee should pay the city a percentage of the gross receipts from the exercise of the franchise; at the end of the period the plant should become the property of the city, if the latter so desire, either without further compensation than the original grant, or, if additional compensation be paid, it should not in any way include or be based upon any valuation of or allowance for the franchise itself, which at the termination of the grant should ipso facto revert to the public; every grant of a franchise should contain ample provision, enforceable by forfeiture of the grant, or otherwise, to secure efficient public service at reasonable rates; every grantee should be obliged to render to the city complete accounts of its financial condition, including its receipts from all sources and its expenditures for all purposes, such account to be public records; the books and accounts of the grantee should be at all reasonable times open to the examination of the city's fiscal officer or his representatives."

The charter report as a whole, a bulky document of over 50 printed pages, is characterized by an expert as "in some respects the most socialistic document ever signed by American citizens."

A Sweeping Municipal Programme at Haverhill, Mass.

A new mayor, Mr. J. C. Chase, has just been elected at Haverhill, Mass. He is twenty-eight years old and a clerk in a co-operative grocery store. The office carries with it a salary of $2,000 a year. The platform of the local social democracy platform, on which he has been elected, is as follows:

Article 1. The acquisition by the municipality of the public utilities, such as street railroads, gas and electric light plants, and all other utilities requiring a franchise, the same to be operated by the operatives, co-operatively subject by direct vote to the whole people; the employees to elect their own superior officers, but no employee to be discharged for political reasons.

Art. 2. We demand the abolition of the contract labor system on all public works.

Art. 3. We demand that eight hours constitute a day's work, with a minimum wage of $2 per diem.

Art. 4. We demand that all salaries and wages paid by the municipality be in proportion to the services rendered.

Art. 5. We demand that the city, when necessary, furnish proper food, clothing and shoes to all children who are kept at home on account of lack of proper food, clothing and shoes.

Art. 6. We demand that the full powers of the municipality be exercised for the relief of the unemployed, not by charity, but by the establishment of public works for their employment.

Art. 7. We demand the abolition of grade crossings and every other menace to human health and life.

Art. 8. We demand that the burden of taxation be distributed in exact proportion to the holdings of each citizen.

Digitized by Google

Art. 9. We demand the abolition of all secret sessions of the City Council, and that a public record be kept of the vote of each member on all questions.

Art. 10. We demand the adoption of the principles of the initiative and referendum and proportional representation.

Art. 11. We demand that all officers be subject to recall by the respective constituencies.

Art. 12. We demand the abolishment of secret balloting in the City Council.

Mayor Chase proposes to bring each plank in the platform forward and to make a "fighting issue" of it. He does not state what the "burden of taxation" is going to be as the result.

Municipal Lighting Row in Berlin.

The Municipal Council of Berlin recently determined to approve a contract between the municipality and the various Berlin electrical works, according to which these firms and companies will supply electricity to the city till the year 1915, while the municipality will participate to a considerable extent in the profits. A violent controversy has raged for some time around the question of the contract. The Social Democrats for once found themselves in agreement with the members of the reactionary parties in advocating a municipal monopoly in electricity. Those who supported the companies were attacked as representatives of the worst form of "capitalism." The Berlin magistracy was accused of pusillanimity in declining to follow the example of much smaller towns in taking over the responsibility for electric lighting and electric motive power. The view ultimately prevailed, however, that the electric industry was still in an early stage of its development, and that new inventions might easily place the capital value of the existing works and machinery in a doubtful position. The contract was finally approved in the Municipal Council by 66 votes to 51.

ROCHESTER, N. Y.—Mayor Warner has filed a memorandum with the City Council recommending the construction of a municipal plant as soon as the present contract with the Gas & Electric Co. runs out. The cost of city lighting in 1898 is put by him at about $230,000.

Data on the Efficiency of Electric Pumps.

THE two accompanying diagrams will be interesting as showing graphically just what efficiency one may expect to obtain with an electrically driven mine pump. This test was run

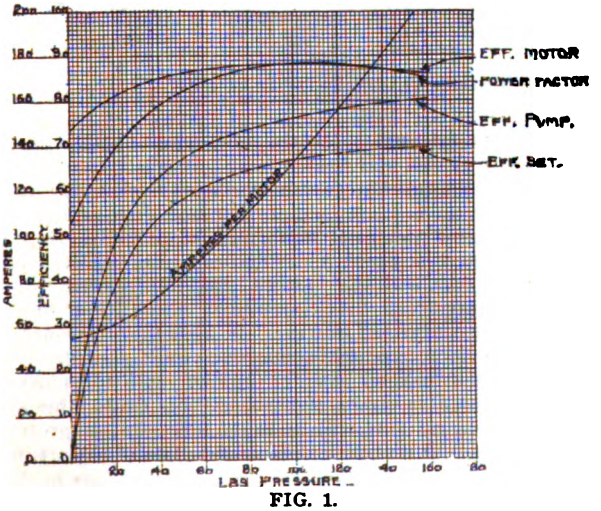


FIG. 1.

on an 11 x 12 horizontal triplex pump manufactured by Henry R. Worthington, New York, and driven through a double reduction of machine cut spur gearing by two 65 h. p. General Electric Co. alternating current motors. The speed of the motors was 450 revs., and that of the pump 45, making a total gear ratio of 10 to 1. The normal capacity of the pump was 1,250 gallons per minute, the head 350 feet.

The first test (Fig. 1) was run at constant speed and a variable head. The voltage of the motors was kept constant at 220, and the frequency constant at 60 cycles. The head was measured by pressure gauges on the delivery pipe, the quantity of water by the plunger displacement, less an allowance of 2 per cent. for slippage. The total input at the motors was measured by wattmeters placed in the main circuit. The following readings were taken:

Volts	Total pressure	Head in feet	EFFICIENCIES. Pump	Motors	Set	Power factor	Amps
220	25	57.5	53.7	82.7	44.4	72.6	63.
220	50	115.	67.	86.3	57.8	82.	82.
220	100	231.	76.1	88.	67.	88.5	133.
220	152	350.	80.1	86.5	69.3	85.6	198.

The second test (Fig. 2) was run under a constant head at variable speed, the pressure being kept steady at 100 pounds

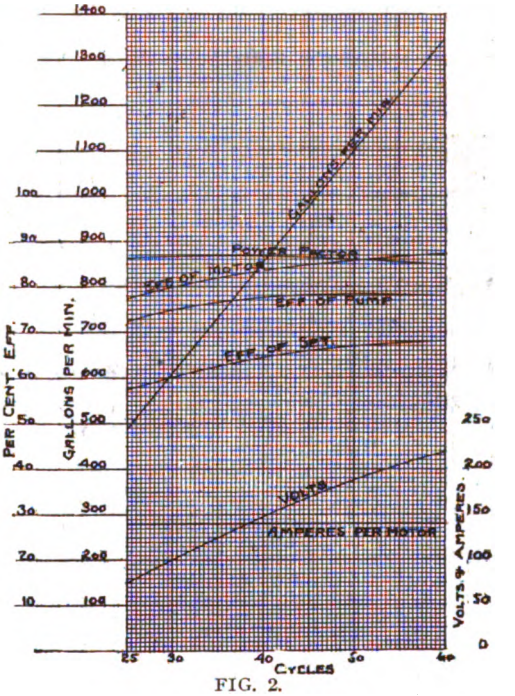


FIG. 2.

per square inch, and the voltage at 220. The following readings were taken:

Cycles	Gals. per minute	EFFICIENCIES. Pump	Motors	Set	Power factor	Amps.	Volts
25	490	72.3	77.4	56.	86.5	140	74
40	795	77.5	83.6	64.8	86.8	140	147
50	1,040	78.2	86.	67.	86.	140	187
60	1,350	78.	87.3	68.	85.	140	220

The test was run under the supervision of disinterested engineers, the efficiency curves being plotted directly from the data obtained. The first curve represents the efficiency of the motor, the second curve the efficiency of the pump and gearing, and the third curve the efficiency of the complete set from the wire to the water column.

Considering that the water end had six single acting outside packed plungers and that the pump had just come from the shop, all the working parts being stiff and not yet having worked down to a perfect bearing, the results obtained are thought to be remarkably good.

ORE SEPARATION.—The Ball Induction Ore Separating Company, of New York City, has been formed for the purpose of buying, selling, owning and controlling letters patent on mechanical, electrical and chemical devices for gold and silver mining. Capital subscribed, $1,500, with the privilege of increasing to $5,000,000. The shares are $100 each, and are held by Edgar M. Hoagland, Otis S. Sage, Clinton M. Ball, James Sheldon, Jr., and Willis S. Merriam, all of New York City.

Digitized by Google

NEWS & NOTES

The Paris Exposition of 1900.

BY FRANCIS E. DRAKE.
(Director of Machinery and Electricity, U. S. Commission.)

THOUGH occupying only about one-half the area of the World's Columbian Exposition at Chicago, the Paris Exposition of 1900 will have great opportunity for the satisfactory presentation of the Arts of Peace. The location of the grounds is practically in the heart of Paris and, lying, as they do, on both sides of the River Seine, affords an unrivalled opportunity for providing comfortably for great crowds.[1]

The great main gate of the Exposition will be placed at the historic Place de la Concorde, and will be capable of caring for 65,000 people an hour. Scores of other entrances will be provided, so that each section of the city may be amply accommodated.

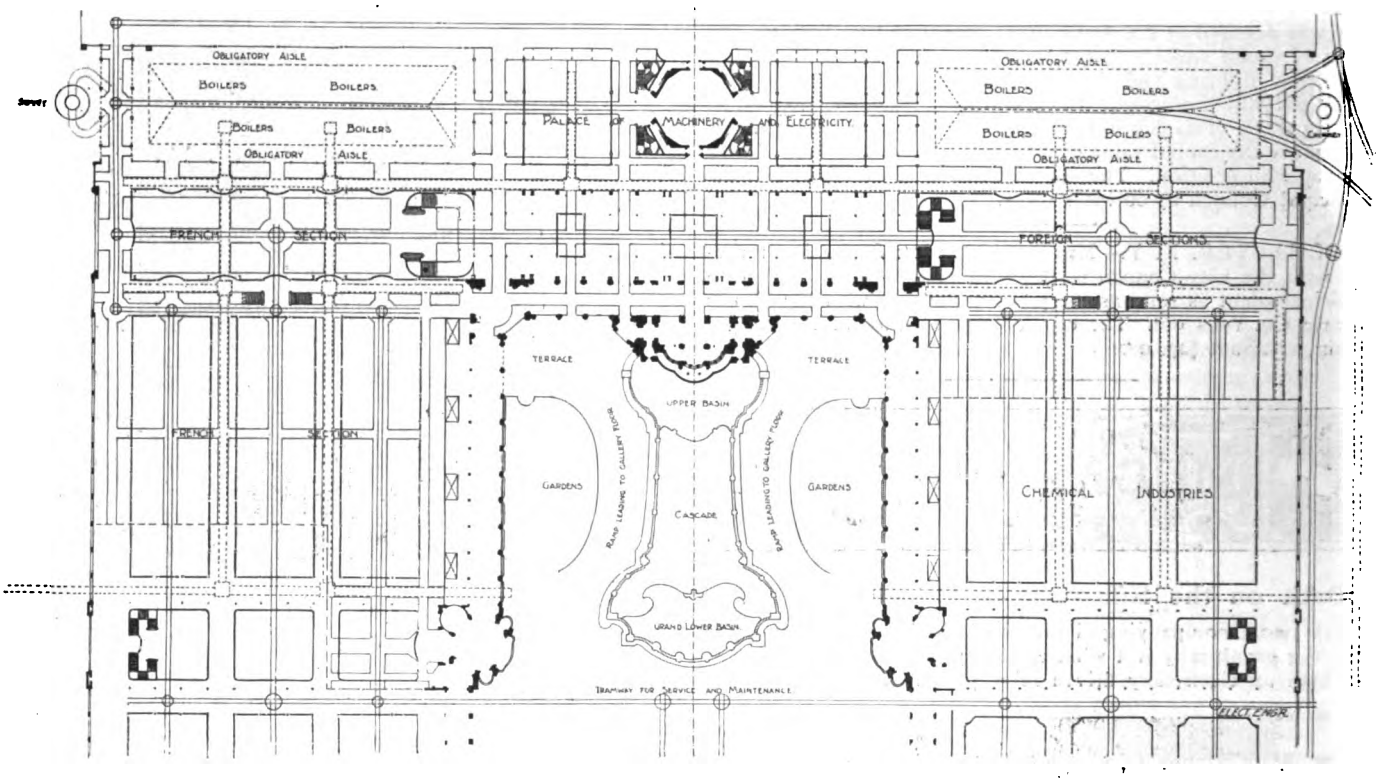
On the south side of the River Seine the greater majority of the principal palaces and attractions will be installed. The Esplanade des Invalides, a rectangular tract lying immediately north of the Hotel des Invalides, will contain palaces devoted to the exhibition of general manufactures. This tract will be connected with the grounds on the north side of the river and the Champs Elysees by the magnificent new bridge of Alexander III., now under construction. From the Esplanade des Invalides to the Champs de Mars, along the left bank of the river, will be placed the official pavilions of the great nations, amongst which will be the building of the United States. Between the bridge of the Invalides and the Champs de Mars will be placed the buildings devoted to the exhibits of the Army and Navy. Between the Champs de Mars and the river will be placed a building devoted to marine navigation and another to contain the exhibits pertaining to forestry and fisheries.

On the famed Champs de Mars will be found the several great palaces of the Exposition, in which will be housed practically three-fourths of the exhibits. The palaces on this space will be built around three sides of the rectangle and are named as follows: Palace of Agriculture, Palace of Electricity, Palace of Machinery, Palace of Transportation and Civil Engineering, Palace of Textiles and Textile Fabrics, Palace of Mines and Metallurgy, Palace of Chemical Industries, and Palace of Education and Liberal Arts.

The great Eiffel Tower, which was such a conspicuous attraction at the Paris Exposition of 1889, will remain at the north end of the Champs de Mars, and again interest and attract all visitors to this great Fair.

On the north, or right, side of the river, will be found, beginning at the Place de la Concorde, in the order named, the two permanent Art Palaces, a section of Old Paris, Palace of Horticulture and Arboriculture, the Hall of Social Economy and International Congresses, and the Palace of the Trocadero and Trocadero Gardens, wherein will be located the exhibits of the Colonies.

At the Park of Vincennes, some eight miles distant, will be located an annex to the Exposition proper, where the railway exhibits will be placed, also the automobile, bicycle and similar displays. At this annex provision will be made for international athletic sports, and, owing to the attractive character of the park, thousands of people will visit this annex daily. Ample means of transportation from the Exposition proper will be provided, both by rail and boat.



PALACE OF MACHINERY AND ELECTRICITY, CASCADE AND BASINS, PARIS EXPOSITION, 1900.

The part which machinery and electricity will play in this coming Exposition is a more important one than ever assumed by these two great industries in former expositions. In a general way it may be said that but few important changes or improvements will be shown in the service of the Paris Exposition over the Columbian Exposition of 1893. The French classification, however, is a distinct advance over that of any previous exposition, inasmuch as it provides for the installation of the finished product together with the machinery and processes used in connection therewith. Under this classification collective exhibits will be most successful in presenting to the visitors a clear understanding of the state of the art in that particular industry.

The great service power plant of the Exposition will occupy a favorable position in the main group of buildings. It will be installed immediately adjoining the space allotted for the exhibits of electrical and other machinery, and any benefit which might naturally accrue to the builder of machinery installed in

[1]An article with several illustrations, in regard to the Exposition and main engineering features, appeared in The Electrical Engineer, Oct. 27, 1898.

Digitized by Google

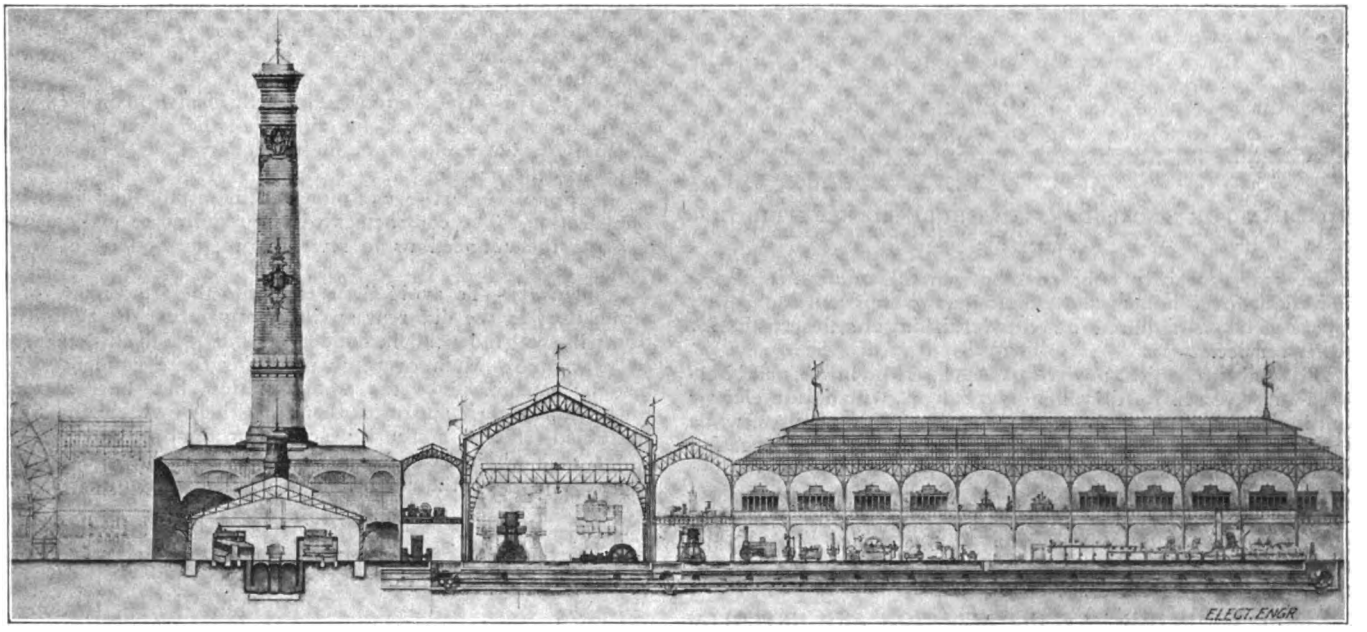
the service plant, will be accentuated and made more apparent by reason of its being located in close proximity to the exhibits not offered for regular service. The capacity of the boiler plant for the service of the Exposition will be approximately 20,000 h. p. The two plants will feed into one general system of mains and distributors, and either, or both, may be utilized at the same time, as occasion requires.

The engines and generators for this power plant will be placed in close proximity to the underground subways carrying the steam and other mains. Each power unit must be of the direct connected type; the generator armature being mounted direct upon the extended shaft of the engine. The designation of these units, according to the Exposition nomenclature, will be "Electrogene Groups." It is proposed by the administration to divide the total power comprised in the various Electrogene Groups required, equally among the French and foreign builders. From present indications manufacturers will offer Electrogene Groups largely in excess of the requirements of the Exposition. No actual contracts have as yet been made for either the French or foreign sections, except a nominal arrangement entered into some time ago with three German manufacturers, who desire to furnish an aggregate approximating 5,000 h. p.

luminated by vari-colored lights, thus making a most brilliant and striking attraction for the evening. A very ingenious scheme has been undertaken in connection with this Chateau d'Eau. All of the water used in the power plant for condensing purposes is to be discharged through the Chateau d'Eau, and the cascades surrounding it, thus making use of this water in artistic effects, and obviating the necessity of pumping from the river another great volume of water simply for fountain use.

There will be no regular compressed air service established by the Exposition Administration, but arrangements will be made with the City Public Service Company, whereby compressed air mains will be brought into the Exposition buildings and air service offered to the exhibitors at the regular city rates, less 10 per cent.

The administration has considered well the necessity for making the gallery space in the various palaces as accessible to the public as possible, and provision has been made, not only for numerous vertical elevators of steam, electric or hydraulic type, but for a large number of inclined elevating ways, or "rolling carpets," to carry the passengers easily and speedily from the crowded ground floor to the galleries, where many interesting and instructive exhibits will be installed. The limited ground



SECTIONAL VIEW OF POWER PLANTS AND MACHINERY HALL, WITH ORNAMENTAL CHIMNEY, PARIS EXPOSITION, 1900.

The location of the Electrogene Groups operating as generating units for the power plant, will be within the regular exhibit space devoted to the Department of Machinery and Electricity. Electricity will furnish the motive power for the operation of an intramural elevated railway, which will encircle the Champs de Mars, pass in front of the main palace on the Esplanade des Invalides, and along the Quay d'Orsay from the bridge of Alexander III., to the Eiffel Tower.

Not all of the main palaces will be lighted at night. The Palace of Manufacturers, Palace of Electricity, Palace of Transportation and Civil Engineering, Palace of Textiles, and, perhaps, one or two other palaces will be well illuminated every evening. The great Hall of Fêtes, which occupies a central position in the Palace of Agriculture, will be illuminated brilliantly whenever in use for evening gatherings. The Palace of Education and Liberal Arts, Palace of Mines and Metallurgy, Palace of Chemical Industries, and Palace of Agriculture will not be equipped for evening illumination.

It is the Palace of Electricity to which all eyes will naturally turn at night, and, as its main facade reaches across the entire width of the open plaza in the centre of the Champs de Mars, splendid opportunity will be afforded for the attractive treatment of the architectural features of the exterior of this palace. Immediately in front of the Palace of Electricity is the grand Chateau d'Eau, which, as planned, will assume the character of an immense fountain with a series of cascades, all to be effectively il-

area at this Exposition makes necessary the husbanding of all available gallery space. On the Champs de Mars there will be installed fourteen of these elevators, or "escaladers," which will have a capacity each of not less than three thousand passengers per hour. A fee not exceeding two cents for each passenger will be charged for the use of these "escaladers."

The exhibit of automobiles, or horseless carriages; trolley cars, railway trains, etc., will be made in the special pavilions provided at the annex in the Park of Vincennes. A special track will be provided there for trials and tests, and for the daily speeding of the various automobiles, bicycles, tricycles, etc. The electric vehicle is at present very popular in Paris, and will no doubt come in for its full share of interest.

In addition to the Contemporary Exposition, the official classification provides for the installation of a retrospective exhibit, which shall present an historical view of the progress in all branches of industry during this century. The department of electricity has been especially favored in this regard by the construction of a special Salon d'Honneur within the Palace of Electricity, where the retrospective exhibit covering the great field of electricity may be properly undertaken, and where the personal exhibits of the great inventors of the century, and the collective exhibits of associations or individuals may, in their several ways, illustrate the evolution and advance of science.

For the information of those interested in the organization of the technical service under the Director-General of Exploita-

Digitized by Google

tion, it is desirable to state that the mechanical installations will be under the immediate direction of M. Ch. Bourdon, professor of the Central School of Arts and Manufactures. The work of this department falls under two distinct categories. The first relates to the execution of the necessary installations for motive power, and may be subdivided as follows:

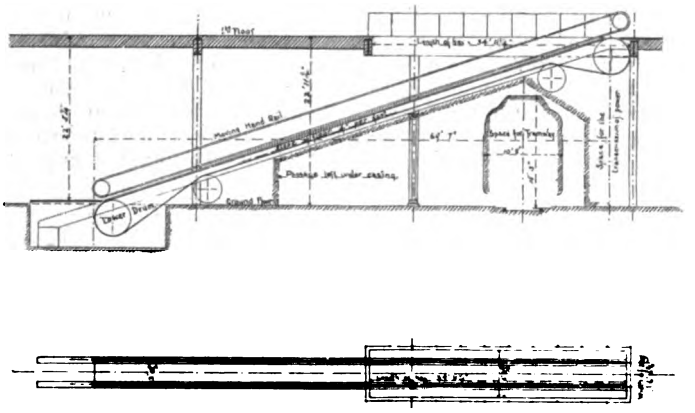
(a) Production of Steam—1st. Installation of boilers; 2. Construction of flues and chimneys.

(b) Distribution of Water and Steam—1st. Construction of subways; 2d. Installation of steam mains, etc.

(c) Production of Power—Installation of Electrogene groups.

The distribution of motive power is practically assigned to the Service of Electric Installations.

The work under the second category is of an administrative



THE PLAN FOR "ESCALADERS" OR INCLINED ELECTRIC ELEVATORS.

order, and especially concerns the general conditions of exploitation of the boilers and electrogene groups and such other apparatus as is required for the furnishing of the steam for power service.

The total mechanical power furnished will be in the neighborhood of 20,000 h. p., of which 15,000 h. p. will be for electric lighting and 5,000 h. p. for motor service. These figures, while not absolutely correct, are those used by the administration as the basis of the installation.

In the two power plants the boilers will be placed in two lines of batteries with the boilers back to back. Ample space for general circulation of the public has been provided.

The following conditions have been established for the installation of boilers:

GENERAL CONDITIONS OF INSTALLATION AND EXPLOITATION OF STEAM BOILERS.

Article 1. General Requirements.—The steam required for the production of motive power for the Universal Exposition of 1900 will be produced by two distinct plants; one called "Usine La Bourdonnais," being reserved for French builders, which will be placed in a court of 117 by 40 meters situated between the Palace of Electricity, Palace of Agriculture, Palace of Machinery and the passage along the Avenue de la Bourdonnais; the second, reserved for foreign builders, will be placed in a court situated next to the Avenue Suffren, and called "Usine Suffren."

These boiler plants will be formed by groups of boilers, each group being able to produce under normal conditions a minimum of 22,000 pounds and a maximum of 44,000 pounds of steam per hour.

The administration of the Exposition will not contract for more than one group with the same builder.

Art. 2. Special Requirements.—As the apparatus installed under these articles will also be considered as exhibits, the conditions of the General Regulations of the Exposition will apply to these groups.

The apparatus will be submitted to the examination of the International Jury and admitted to compete for awards. In consequence of this particular stipulation the furnishing of these apparatus will be made under the same conditions as govern other exhibited apparatus, that is, nothing will be granted to the exhibitor as allowance for expense except for the installation and exploitation of the apparatus, which remuneration is specified in Art. 10, below.

Art. 3. Conditions of Installations.—The installation of the apparatus will be made according to plans established by the builder and accepted by the Director-General of Exploitation on a favorable report of the Technical Committee, and annexed to each copy of the contract. The builders will conform to the regulations enjoined by the administration concerning public safety.

Foundations.—The administration will furnish the necessary floor space to the exhibitors, who will provide all foundations and accessory works at their own expense.

The materials employed for the construction of these foundations will remain, after the Exposition is over, the property of the builders, who may remove or abandon them, as they may elect.

Chimney Flues.—The main flues for smoke from both boiler plants will be established at the expense of the administration. Junction pieces will be prepared to receive the ends of the flues from the different groups of boilers. The private flues connecting the boilers to the main flues will be made by the contractors at their expense, after the approval of the plans by the Director-General of Exploitation.

Smokestacks.—A large smokestack will be established by the administration for each boiler house.

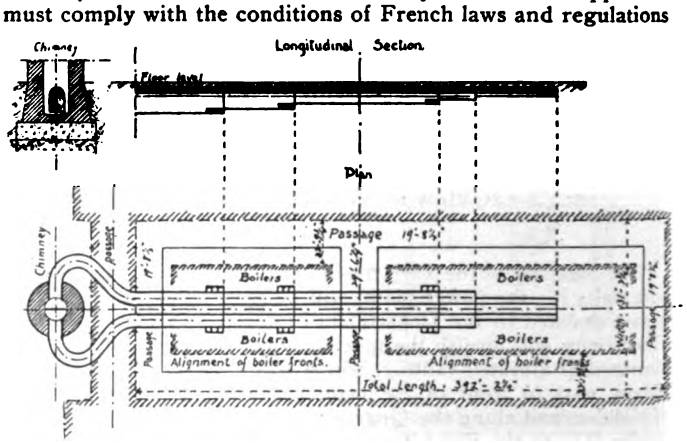
Steam Pipes.—The administration will furnish the main piping connecting the boiler houses with the engine rooms and the different parts of the Exposition where steam is required, but each builder must furnish at his own expense the connection from his boilers to said main pipes.

Feed Water.—The administration will furnish main feed water pipes through which will be conducted the water required for the boilers, but contractors must connect their feed tanks or pumps to these mains.

Sewerage.—General sewer pipes will be established by the administration. The contractors will be required to make at their expense the connections to sewers from the boilers, blow-offs, drains, etc.

Condensers.—To avoid the escape into the atmosphere of the steam used in the different auxiliary apparatus, the administration will erect independent condensers into which this steam will be evacuated. Main overflow pipes for these condensers will also be established by the administration, but the contractors must connect their apparatus thereto at their own expense. They must also establish a security escape into the open air.

Art. 4. Technical Conditions. Security.—The steam apparatus must comply with the conditions of French laws and regulations



GENERAL ARRANGEMENT OF FLUES, BREECHING AND CHIMNEY, FOR ONE SECTION OF THE BOILER PLANT.

concerning public security, unless exceptions have been granted by the Minister of Public Works; that is, apparatus built according to legal requirements and subjected to official security tests established by law in the originating country may be accepted upon the proper recognition of such requirements and tests being in consonance with French law. The administration, on the advice of the Technical Committee, reserves the right to require such other safeguards or safety appliances as it may deem necessary for apparatus working near the public aisles and passageways.

Plans of Apparatus.—Plans of the proposed apparatus for the production of steam as well as the auxiliary apparatus therefor must be previously submitted to the Director-General of Exploitation, when they will be examined by the Technical Committee.

Each contract concerning the furnishing of steam will be ac-

Digitized by Google

cepted by the administration only after a favorable report of the Technical Committee, a copy of which must be annexed to each copy of said contract.

The boilers and their accessories must be established and the conditions of regulation carefully observed for a normal working pressure of 156 pounds per square inch.

Plans of Installation.—General and detailed drawings must also be submitted to the Technical Committee, this committee prescribing the conditions to which the builders must conform in the installation they undertake.

The committee may particularly require satisfactory arrangement concerning the installation of the boilers for the chimney flues, water pipes, steam pipes, etc. All feed pipes, etc., must be installed and maintained in perfect condition.

The furnaces shall be constructed so as to avoid the production of opaque smoke, the fuel adopted by the builder being carefully selected with this end in view.

Art. 5. Measuring and Controlling Apparatus.—The builders agree to mount on their boilers such indicators, gauges or verification apparatus as the Director-General of Exploitation may deem necessary, and to have such experiments made as the Technical Committee or Jury of Awards may demand.

The builders will furnish, mount and keep in repair at their own expense during all the time of the Exposition, a suitable water meter of one of the patterns accepted by the administration, to be installed on the pipe supplying the feed water to their boilers; readings of the meter to be taken every day by the inspector of mechanical service, who shall keep the key to such water gauge; two seals to be placed by said inspector on the feed and outlet pipes of the meter.

The builders agree not to blow off the boilers except in the presence of said inspector, and will make sure that the evacuation and overflow cocks are closed in due time, so as not to show erroneous results concerning the vaporization.

A special steam outlet will be located between the boiler and the main throttle valve, according to the conditions to be prescribed by the Director-General of Exploitation, which will permit the measurement of the water carried away by steam. Arrangements will also be made for the reading of the temperature of the gases escaping from the furnaces and for analyzing same.

Art. 6. Duration of Service.—The duration of service is that of the exposition itself; that is, from April 15 to Nov. 15, 1900, 205 days. The administration reserves the right to vary this period not exceeding thirty days, in which case no modification concerning the remuneration allowed will be made.

Art. 7. Date of Delivery.—The contractors agree to begin the masonry work for the foundations not later than Oct. 15, 1899. If at that time they have not taken possession of the space granted to them, and are unable to show satisfactory progress in the construction of the apparatus and in arrangement for prompt delivery, thus assuring the administration of the fulfilment of their obligations—the right to cancel without indemnity the contract between the administration and the contractor, is reserved to the Exposition officials.

The said contractors must complete the installation of their groups on or before March 1, 1900; on this date the furnaces will be heated and the boilers submitted to trial by the builders themselves under the control of inspectors. An official report will be made stating the results. These trials may be renewed at any time during the Exposition at the option of the administration.

Art. 8. Daily Service.—The duration of each day's service and the duration of working hours will be determined by the Director-General of the Exposition according to service requirements. The builders agree to furnish at any time the maximum amount of steam they have undertaken to supply.

The Director-General of the Exposition will establish between the several builders an equalization of work, so as to permit proper working hours and resting periods for facilitating the visiting, cleaning and repairing of apparatus without causing any inconvenience to or disruption of the regular service.

Art. 9. Financial Conditions.—The feed water will be furnished free of charge, according to the conditions of Art. 3. As explained in said article, the chimney flues as well as the general steam, feed, sewerage and overflow pipes, will be furnished by the contractors at their expense, as well as all dampers, cocks, gutters and, in a general way, all other accessories required.

The administration will furnish the boiler house. The fuel, necessary employés and all other expenses concerning the installation, as well as for the exploitation and trials, will be at the expense of the builders. The exploitation will therefore entirely be at the expense of the builders, particularly that which concerns fuel, employés, etc., and these expenses will be settled directly by them without any interference by, or responsibility resting on the administration, which will in no case assume any expenses incurred inside the grounds of the Exposition by the builders engaged to furnish the steam.

Within the grounds no fuel ashes, etc., will be allowed to be stored, except in sacks.

The remuneration allowed to builders includes:

1. A fixed sum representing the administration's contribution toward the expenses of installation of boilers and their accessories. This sum is fixed at $289.50 per 2,200 pounds of productive capacity of steam per hour as contracted for by the administration, and appearing on the private contract of each bidder.

This productive capacity will be determined by the Technical Committee, and will, in any case, not exceed 122 pounds per square foot of grate surface.

2. A sum representing the administration's contribution to the expense of exploitation, which sum is fixed at 85 cents per 2,200 pounds of steam effectively produced from the opening to the close of the Exposition, and during the working hours fixed by the Director-General of Exploitation.

Art. 10. Terms of Payment.—The remuneration above stipulated will be paid to contractors as follows:

On July 10, 1900, payment of the steam produced from the beginning of the Exposition up to and including June 15. On Sept. 10, 1900, for the steam produced from June 15 to Aug. 15. One month after the close of the Exposition the balance for the steam produced after Aug. 15. That portion of the remuneration allowed toward first cost of installation will be paid in thirds on the same dates.

Art. 11. Penalties Exacted for Delays.—In the event of delay beyond the time fixed in Art. 7, for the installation of the units, the administration will exact the following penalties and will deduct same from any sums which may ultimately be due to contractors from the Exposition:

1. A penalty equal to the allowance corresponding, for the service referred to, to the normal service of the group during a working day of seven hours.

2. A penalty on the allowance made for installation expenses which will be calculated by multiplying the amount of this remuneration by a coefficient of reduction equal to the ratio of the number of days delayed, to the total duration of the Exposition.

Art. 12. Cancellation of Contracts for Excessive Delays.—If the apparatus is not in condition to furnish a regular service beginning with May 15, 1900, the administration reserves to itself the right to cancel the contract made with the builder without indemnity being due to either party, and without remuneration for installation expenses to be paid by the administration.

Art. 13. Penalty in Event of Interruption to Service.—In case of interruption to the regular service, aside from the resting hours fixed by the Director-General of Exploitation, the contractor will have imposed by the administration for each day of said interruption, a penalty equal to the allowance corresponding, for the apparatus referred to, to the normal service of a day of seven working hours.

If this interruption exceeds a period of ten days, a second penalty will be exacted and deducted from the remuneration provided by the administration toward the installation expenses, which penalty will be calculated by multiplying the amount of such remuneration by a coefficient equal to the ratio of the number of days of delay to the total duration of the Exposition.

Art. 14. Accounts.—The administration reserves the right to take for the regulation of the accounts any steps necessary or to make tests and trials so as to be informed as exactly as possible concerning the power produced by the boilers and accessories.

Art. 15. Regulations.—The builders agree to conform to the laws and regulations established by the Director-General of Exploitation. The hours of entrance and exit of the cars bringing the fuel or taking away ashes will be particularly determined.

Art. 16. Employés.—The Director-General of the Exposition will retain the right to require the discharge of any agents or employés in the service of contractors for insubordination, incapacity, intemperance or want of probity.

Art. 17. Responsibility.—The builders agree to take all neces-

Digitized by Google

sary precautions against accidents to visitors. They will be held responsible by the administration for all damages caused by their material, apparatus or employés.

Art. 18. Medical Service.—The builders being considered as exhibitors, as stipulated in Art. 3 above, will not be classed as contractors for the masonry work required; therefore the amount of their contracts will not be submitted to the customary deduction of 1 per cent. for medical service required in Art. 16 of General Conditions. On the other hand, the employés of the builders in case of injury or accident, will receive only the "First help to the injured," the regulations of Art. 3 and 4 of the Arrête Ministériel not applying to them.

Art. 19. Disagreement.—Disagreements between the administration and contractors must be, previous to any definite action, examined by three competent members of the Technical Committee. One of these members will be chosen by the Commissioner-General of the Exposition, the second by the contractor and the third will be chosen by the two first-named members.

The contractors agree to withhold any procedure or action at law until after having submitted the disagreement to the Council of Arbitration as above provided for.

The controlling minds of this great undertaking have not lost sight of the artistic side of questions surrounding the service power plant, and in the construction of the chimneys for the two boiler plants ample provision has been made for the æsthetic treatment of the exterior of the towering stacks which will conduct the gases from the furnaces.

Two monumental chimneys have been designed, each to be ornamented in a manner indicated in the figure. The height of each will be 230 feet above the level of the Champs de Mars, the inside diameter at the base 28 feet, and at the summit 23 feet. These chimneys are to be illuminated at night by either gas or electricity, and will thus trace a striking outline upon the dark background of the sky.

In appropriating funds for the power plant the administration has, upon the advice of the Technical Committee, provided a minimum sum which may be said to be only about one-third of the allowance made for the use of power units at the Columbian Exposition of 1893. The great commercial rivalry between the principal nations of Europe has been a factor in determining the course of the administration. Many large concerns would have granted the use of engines and dynamos during the period of the Exposition without charge, providing advantageous arrangements of space, etc., could have been assured them. It was after mature deliberation, however, that the authorities settled upon a very nominal compensation which should apply alike to French and foreign manufacturers.

The details and conditions surrounding the tenders of electrogene groups are recited at length in the following programme:

GENERAL CONDITIONS OF INSTALLATION AND EXPLOITATION OF ENGINE DYNAMO GROUPS.

Art. 1. General Requirements.—The electrical energy required for the Paris Exposition of 1900 will be produced by engine dynamo groups, the steam engine of which will operate condensing; the generator armature to be mounted direct on the engine shaft, thus excluding all cables and belts.

The administration will contract either with one builder only for the combined group, or simply with the builder of the steam engine and with the builder of the generator.

Art. 2. Technical Requirements.—The steam in the main pipes will have a mean effective pressure of 142 pounds per square inch; this pressure may vary 10 per cent. either above or below normal.

The electric current generated will be delivered to a switchboard furnished by the contractor. The following voltages will be permitted: Continuous current, 125, 250 or 500 volts; alternating current, 2,200 volts with a frequency of 50; three-phase current, 2,200 volts with a frequency of 50.

Art. 3. Special Requirements.—As the apparatus installed under these articles will also be considered as exhibits, the conditions of the General Regulations of the Exposition will apply to these groups. The apparatus will be submitted to the examination of the International Jury and admitted to compete for awards. In consequence of this particular stipulation the furnishing of these groups will be made under the same conditions as govern other exhibited apparatus, that is, nothing will be granted to the exhibitor as allowance for expense, except for the installation and exploitation of the apparatus, which remuneration is specified in Art. 9 below.

Art. 4. Conditions of Installation.—The installation of the apparatus will be made according to plans established by the builder and accepted by the Director-General of Exploitation on a favorable report of the Technical Committee and annexed to each copy of the contract. The builders will conform to the regulations enjoined by the administration concerning public safety.

Foundations.—The administration will furnish the necessary floor space to the exhibitors, who will provide all foundations and accessory works at their own expense.

The materials employed for the construction of these foundations will remain, after the Exposition is over, the property of the builders, who may remove or abandon them, as they may elect.

Piping.—The steam engine builder will establish at his expense special piping to his engine from the main steam pipe provided by the administration. A throttle valve will be supplied by the engine builder at the junction of his piping with the Exposition mains.

The engine builder will also furnish and erect the feed water pipes and evacuation pipes for the hot water of condensation as well as all necessary valves, traps, etc., to be placed at the junction with the main piping.

The pipes conveying live steam and cold water as well as for the outlet of the hot water from condensation will be placed in underground conduits connecting the engines with the underground galleries in which are installed the main distributing pipes. These main galleries and pipes will be established by the administration, and the private piping will be installed by the exhibitors at their expense. Special regulations will fix the details to be observed concerning valves and joints.

Switchboards.—Each generator will be provided with a switchboard having the necessary means of interruption and protection such as are usually employed, also current measuring apparatus to be approved by the administration. The administration also reserves the right to require the use of current registering apparatus.

For the alternating current generators the contractors will be obliged to furnish and install the necessary transformers for the distributing stations, so that the current of those alternators may be rendered available.

Art. 5. Duration of service.—The duration of service is that of the Exposition itself, that is, from April 15 to Nov. 15, 1900, 205 days. The administration reserves the right to vary this period not exceeding thirty days, in which case no modification concerning the remuneration allowed will be made.

Art. 6. Daily Service.—The duration of each day's service and the duration of working hours will be determined by the Director-General of the Exposition according to service requirements. The builders agree to furnish at any time the maximum amount of power they have undertaken to supply.

The Director-General of the Exposition will establish between the several builders an equalization of work so as to permit proper working and resting periods for facilitating the visiting, cleaning and repairing of apparatus without causing any inconvenience to or disruption of the regular service.

Art. 7. Measurement of Energy.—The administration, with the assistance of the contractor's employés, and at his expense, will make such experiments and tests as are necessary to ascertain if the engines and generators are capable of furnishing the power stipulated in the private contracts. An official report will be made concerning these tests. At any time during the Exposition period these tests may be renewed to verify the previous reports.

Art. 8. Financial conditions.—The live steam required by the engines and water for condensing will be furnished by the administration free of charge.

The builders will receive:

1. A fixed sum to remunerate them for a portion of the prime installation expenses.

2. A sum proportionate to the number of hours of work at the normal rating of the group as accepted by the administration. These sums will be fixed according to the power of the units as determined in the private contracts and in accordance with the following tables.

Sums representing amount contributed by the administration toward the first cost of installation are given in Table I.

In the event of the maximum horse power accepted by the administration from foreign builders being such as to make the

Digitized by Google

total remuneration based on Table 2 greater than the total sum for this service as established in Table No. 1, a proportionate reduction will be made on the horse power allowance for each builder which shall be commensurate with the increase in total horse power over the limit established by the appropriation.

TABLE NO. 1.

	Engine.	Dynamo.	Together.
Total maximum contribution	$40,330	$19,300	$65,630
Amount allotted to the French Section (plant La Bourdonnais)	23,165	9,650	32,815
Amount allotted to foreign Section (plant Suffren)	23,165	9,650	32,815

TABLE NO. 2.

Allowance per 1 h. p.	Engine.	Dynamo.	Together.
For the first 1,000 h. p.	$1.92	$0.78	$2.70
For 1,000 to 1,500 h. p.	1.37	0.24	1.61
For all above 1,500 h. p.	1.00	0.18	1.19

The capacity of the groups admitted for service will be so proportioned that this reduction will not exceed 50 per cent.

TABLE NO. 3.

Sums representing the administration's contribution toward the expense of exploiting and operating the electric groups:

Allowance per 1 h. p.	Engine.	Dynamo.	Together.
For the first 1,000 h. p.	$0.102	$0.138	$0.300
From 1,000 to 1,500 h. p.	0.067	0.057	0.124
Above 1,500 h. p.	0.056	0.046	0.102

The administration guarantees to the builders a minimum duration of work fixed at 500 hours.

Art. 9. Terms of Payment.—The remuneration above stipulated will be paid to contractors as follows:

On July 10, 1900, payment of the number of working hours furnished from the beginning of the Exposition up to and including June 15. On Sept. 10, for the number of working hours furnished from June 15 to Aug. 15. One month after the close of the Exposition the balance covering the number of working hours furnished after Aug. 15.

That portion of the remuneration allowed towards first cost of installation will be paid in thirds on the same dates.

Art. 10. Date of Delivery.—The contractors agree to begin the foundations for the engines and dynamos not later than Oct. 15, 1899. If at that time they have not taken possession of the space granted to them and are unable to show satisfactory progress in the construction of the apparatus and in arrangements for prompt delivery, thus assuring the administration of the fulfilment of their obligations, the right to cancel without indemnity the contract between the administration and contractor is reserved to the Exposition officials.

The said contractors must complete the installation of their groups on or before March 15, 1900; on this date will begin the trials mentioned in Art. 7.

Art. 11. Penalties Exacted for Delays.—In the event of delay beyond the time fixed in Art. 10 for the installation of the units, the administration will exact the following penalties and will deduct same from any sums which may ultimately be due to contractors from the Exposition.

1. A penalty equal to the allowance corresponding, for the apparatus referred to, to the normal service of the group during a working day of seven hours.

2. A penalty on the allowance made for installation expenses, which will be calculated by multiplying the amount of this remuneration by a co-efficient of reduction equal to the ratio of the number of days delayed, to the total duration of the Exposition.

Art. 12. Cancellation of Contract for Excessive Delays.—If the apparatus is not in condition to furnish a regular service beginning with May 15, 1900, the administration reserves to itself the right to cancel the contract made with the builder without indemnity being due to either party, and without remuneration for installation expenses to be paid by the administration.

Art. 15. Penalty in Event of Interruption to Service.—In case of interruption to the regular service, aside from the resting hours fixed by the Director-General of Exploitation, the contractor will have imposed by the administration for each day of said interruption a penalty equal to the allowance corresponding for the apparatus referred to, to the normal service of a day of seven working hours. If this interruption exceeds a period of ten days, a second penalty will be calculated by multiplying the amount of such remuneration by a co-efficient equal to the ratio of number of days of delay to the total duration of the Exposition.

Art. 14. Employés.—The Director-General of the Exposition will retain the right to require the discharge of any agents or employés in the service of contractors for insubordination, incapacity, intemperance or want of probity.

Art. 15. Medical Service.—The builders being considered as exhibitors, as stipulated in Art. 3, above, will not be classed as contractors for the masonry work required; therefore the amount of their contracts will not be submitted to the customary deduction of 1 per cent. for medical service required in Art. 16 of the General Conditions.

On the other hand, the employés of the builders in case of injury or accident will receive only the "First help to the injured," the regulations of Arts. 3 and 4 of the Arrêté Ministériel not applying to them.

Art. 16. General Regulations.—The contractors agree to conform to all the regulations promulgated by the Director-General of the Exposition. They will be held responsible for accidents caused by their apparatus or employés.

Disagreements between the administration and contractors must be, previous to any definite action, examined by three competent members of the Technical Committee. One of these members will be chosen by the Director-General of the Exposition, the second by the contractor, and the third will be chosen by the two first-named members.

The contractors agree to withhold any procedure or action at law until after having submitted the disagreement to the Council of Arbitration as above provided for.

A new feature of the Exposition service is the "Escalader," an inclined elevating way, constructed in the form of an endless carpet or belt propelled by a drum at one end. No former Exposition has made such generous provisions for means of carrying the public to the galleries, and as the typical "Escalader" has been so recently brought into public use nearly every one in the commercial world will be anxious to see the results obtained with it. The extent to which the elevating stairway may be successfully used can scarcely be estimated at this time. They are safe, easily installed, simple to operate, and have a capacity far in excess of vertical elevators, so far as transportation from floor to floor of large crowds is concerned. On the Champs de Mars, as noted above, fourteen of these elevators or "escaladers" will be installed, which will have a capacity each of not less than 3,000 passengers per hour. Privilege has been granted the Commissioner General for the United States to install a working exhibit of one or more of these "inclines" in or near some United States section.

Exports of Electrical Material from New York.

The following exports of electrical material are from the port of New York for the week ending Nov. 29: Brazil, 653 packages electrical material, $7,002. British East Indies—147 packages electrical material, $4,456. Bremen—15 cases electrical material, $3,000. British Possessions in Africa—47 cases electrical material, $1,805. Chili—9 cases electrical material, $403. China—28 cases electrical material, $1,417. Hong Kong—12 cases electrical material, $860; 14 cases electrical material, $108. Hamburg, 102 cases electrical material, $11,006. Liverpool—1 case electrical material, $50; 28 cases electrical machinery, $585. London—128 cases electrical material, $8,900. Southampton—2 cases electrical machinery, $104. U. S. of Colombia—3 cases electrical machinery, $1,650. Venezuela—357 cases electrical material, $1,127.

The Recent Big Fire in New York "Skyscrapers."

WITH regard to the recent fire on Broadway, which wiped out a clothing store, then assailed the lofty Home Insurance Building next door, and thus made its way along to the tall home of the Postal Telegraph Cable Co., Mr. C. P. Bruch, the assistant secretary and assistant to the general manager, says:

"The newspaper statements as to damage to our plant in the recent fire were very much exaggerated. As a matter of fact our operating department stopped work from 10:39 p. m. to 1:15 a. m. This was more a matter of precaution than of necessity; but on account of the extent of the fire in the adjoining buildings, the fact that our window panes were being cracked and

Digitized by Google

window frames scorched and because the Fire Department was in possession of our building, it was thought wise to disconnect the switchboards, instruments, etc., to collect the business in the office and hold it in a safe place and to send the night force to the lower floors where there was absolutely no danger. There was no damage done to the switchboards or apparatus. All that was necessary in resuming business was to wipe a little water off the switchboards, mop the floor and restore the connections. The damage to the building itself consisted mainly of broken windows and burnt window frames, in addition to some wet ceilings and walls caused by burst hose. The carpets and furniture in the Hardware Club were damaged to some extent by water and by firemen who were working on that floor and the roof. Although matters appeared very serious at one time, I understand that our men did not lose their heads, but faced the situation cooly, and did everything in their power to secure the safety of the business and the company's property."

Telephone Tolls in New York City.

The New York Merchants' and Manufacturers' Board of Trade met last week. President C. C. Shayne presided. The Telephone Committee, of which R. M. Walters is chairman, reported the draft of a bill to be submitted to the next session of the Legislature, making it unlawful in any city of this State, containing a population of 500,000 or more, to charge any single telephone subscriber more than $50 a year for any number of messages less than 1,000 transmitted within the corporate limits of such city, or to charge more than 5 cents for each message in excess of 1,000, persons or corporations overcharging to forfeit $100, to be recovered with the excess charges by the person paying the overcharge, if action is begun within one year.

Another Electrical Exhibition Next May.

Mr. C. O. Baker, Jr., president of the Electrical Exhibition Company, has signed a lease of the Madison Square Garden for another electrical show, to be held during May of next year, under the auspices of and in connection with the twenty-second convention of the National Electric Light Association. Although the last show occurred in May, when the war interest was most intense, it drew large crowds of people. Electrical development is so fast nowadays and the newspapers have described so many of the newer and more wonderful inventions that an exceedingly interesting and successful show is looked for. The officers of the Electrical Exhibition Company are: C. O. Baker, Jr., president; H. L. Shippy, vice-president; George F. Porter, secretary and treasurer; Marcus Nathan, general manager; H. H. Harrison, L. F. Requa, J. W. Godfrey and C. A. Lieb, directors.

SOCIETY & CLUB NOTES

Dinner of the First Volunteer Engineer Regiment to Col. Eugene Griffin.

THE officers of the First Regiment U. S. Volunteer Engineers gave a dinner Dec. 3 at Sherry's, New York, in honor of their colonel, Eugene Griffin. Among those present as guests were: Gen. W. S. Randolph, Col. A. S. Kimball, John Thomson, Esq., J. C. Bishop, Esq., Col. A. G. Mills, Gen. C. G. Sawtelle, Gen. Alex. Shaler, Lieut. W. M. Cruikshank, U. S. A.; G. F. Mairs, Esq., C. A. Coffin, Esq. Lieut. Col. Hodges, of the Engineers, presided, and Major Ira A. Shaler, Major L. L. Seaman, as well as nearly all the officers were present.

After coffee Lieut. Col. Hodges rose and called the attention of those present to the work done by Col. Griffin in organizing the Engineers, saying that the colonel had taken 1,200 raw recruits and in a short time had drilled them into a body of men equal to regulars. After other words of esteem and appreciation, Col. Hodges presented Colonel Griffin with a handsome silver loving cup.

In acknowledging the souvenir, Colonel Griffin said: A man, even if devoid of all modesty, might well hesitate to take to himself all the complimentary remarks which have been addressed to me by Colonel Hodges. As it is, I cannot but feel that I have been substituted for the regiment, and that the credit given to me belongs rather to it. A regiment is a military unit. Colonel Hodges and other distinguished lexicographers, define a unit as a single thing, or one. The absence of the big head is what distinguishes the "1" from the "I," and the broad base is the foundation of the unit. The rank and file is the foundation of this regiment, and it is needless for me to tell engineers that without a good foundation we could not have constructed a good regiment.

Having as a base a carefully selected rank and file, probably greatly superior on the average to the men of any other regiment in the service, we should have been without an excuse had we not built up a first-class organization ready for whatever the constituted authorities might devolve upon us. That our work has been successful to a reasonable degree is due to our officers, and I can justly feel a measure of pride in having been instrumental in the selection of such officers, and, through them, in the selection of the men.

On the declaration of war last spring I felt, as every West

COL. EUGENE GRIFFIN.

Point graduate in civil life felt, that I was again called to active duty. It is easy to place one's services at the disposal of the Government. It is not always easy for the Government to find places for the 20,000 or more men whose services are so offered. I therefore determined to not only tender my services, but to suggest specifically the way in which I thought I could be made use of.

My position in civil life brings me into contact with engineers all over the country. This suggested at once a field of usefulness—the organization of the engineers for military service. I stated this to the Secretary of War, and suggested the organization of a Brigade of Engineers of 3,500 men. The Secretary thought that 3,500 technical troops was too large a proportion.

I quoted the War of Rebellion records to show that in 1864-5 in Meade's Army of the Potomac over 4 per cent. of the total force were engineer troops; that in Thomas' Army of the Cumberland over 5 per cent. were engineers; that in Sherman's army in the march to the sea about 7½ per cent. of the troops were engineers, and, generally, that in all properly constituted armies

Digitized by Google

the proportion of engineers is about 5 per cent. As we were then raising 125,000 volunteers, the proportion would be 6,250 engineers, nearly double the number I suggested. The Secretary acquiesced, and I wrote the bill authorizing the organization of a brigade of engineers, which bill I requested Senator Proctor to introduce in the Senate and Mr. Hull in the House. The second paragraph, in reference to the ten regiments of immunes, was added by the Military Committee in the Senate, and this paragraph provoked some discussion, but ultimately the bill passed with the first paragraph as originally drafted, and with no opposition whatever expressed to the Engineer Brigade.

The First Regiment was authorized at once, and the Second and Third soon afterwards. The selection of officers for the First Regiment was left to a board consisting of Gen. Gillespie and myself, and I prepared the regulations under which the examinations were held. Officers were detailed for recruiting service, and every man was subjected to a careful examination by such officers before being accepted and passed on to the doctors for medical examination. As a matter of statistics, the recruiting officers rejected more than twice as many men as the doctors. We can therefore truly say that officers and men were all carefully selected.

The first detachment of recruits arrived at Peekskill on the 23d of June. On the 25th, Company A was mustered into the service. One month afterwards, on the 25th of July, for the first time, the entire regiment attended dress parade in line of battalion masses. The last company had then had its uniforms and guns three days. On the 28th of July the complete muster in of the regiment was effected. Only eight days after this (Aug. 5) we broke camp and started down the river for Puerto Rico.

It should be recalled that we were armed, equipped and drilled as infantry, and it turned out that General Miles had intended to use us as infantry—at the outset at least. On reporting to General Miles at Ponce he informed me that had we arrived two days earlier we would not have landed at Ponce, but that he was to have sent us around to the north side of the island to land at Arecibo and capture that city, then in possession of the Spaniards. Arecibo is about forty miles west of San Juan, with which place it is connected by railroad, so that had we sailed four days earlier we should have had a most interesting experience. As it was, we landed at Ponce, and the next three months were devoted to engineering work, outside of the military routine of guards, drills, etc.

One company was immediately detailed as the headquarters guard for Major General Wilson, who was in immediate command after General Miles' departure, and Colonel Hodges, Major Sewall and myself were detailed as president and members of a military commission, which was interesting as being the first military commission to sit on foreign soil since 1847.

The engineering work performed by the regiment consisted of a detailed topographical survey of the main highway from the sea, through Ponce to Aibonito; a survey of the Aibonito Pass, showing the locations of the Spanish batteries and intrenchments; a detailed hydrographical survey of the harbors of Ponce and Guanica; the rebuilding of the fine masonry bridges destroyed by the Spaniards on the military road which crosses the island; the building of a dock and commissary storehouses; the setting up of an ice plant and refrigerating plant for the general hospital at Ponce, and the construction of buildings for this purpose; the building of a concreted high level reservoir for the hospital, and the completion of the water supply system, including setting up the pumps, laying the pipes, etc.; the partial construction of Fort Capron on the heights overlooking the entrance to Guanica harbor, and the building of a road up the side of the mountain leading to the fort; the laying out of the first national cemetery in Puerto Rico, and many other minor works "too numerous to mention."

We sailed from Ponce homeward bound on the 18th of November, and reached New York on the 24th. We went to Puerto Rico with 48 officers and 1,097 men. We returned with 47 officers and 857 men. We left 1 officer and 61 men in the hospitals at Ponce and Guanica; many men had previously been discharged or sent home on sick furlough, and many of the latter reported for duty upon our arrival.

The saddest feature of our experience has been the loss by death of 1 officer and 13 men, who gave their lives for their country as surely as did those who fell at San Juan Hill and El Caney.

"Can storied urn or animated bust,
Back to its mansion call the fleeting breath?
Can honor's voice provoke the silent dust,
Or flattery soothe the dull, cold ear of death?"

While Gray's ever-living words are sadly true, we shall always bear in affectionate memory the names of our fourteen comrades who sealed their love of country with that supreme sacrifice of life.

Such, in brief, is the history of this regiment. Had Toral held out at Santiago for a few days more, had Cervera delayed his dash for liberty, this story might have been very different. It is at least possible that under such changed conditions the war would even yet be in progress, and that the final act would be the siege of Havana. However necessary it may have been to prove the value of engineer troops under the ordinary conditions of modern warfare, every military man would have recognized the necessity and value of engineers in siege operations. The opportunity would have been offered us to introduce modern engineering methods and to change in many ways the traditional methods for the "Attack of fortified places." Searchlights would have prevented sorties, and electric motors would have played no small part in the trenches. Hospitals would have been lighted by electricity and cooled by fan motors. The wounded on the battlefield would have been found at night by the aid of searchlights, and the surgeons would have operated in field hospitals by the aid of the electric light.

The whole modern development of electricity has taken place since the last great war, that between the Turks and the Russians in 1878.

In other branches of engineering great progress has been made. Modern high explosives are more powerful, easier and safer to handle, and, therefore, more useful for many purposes. The development in the use of nickel steel, Harveyized plates, and other forms of defensive armor for battleships, would have been applied to modern sap rollers and trench defences, and it is almost certain that the siege of Havana, under the conditions now existing, would have gone down to history as marking a new era in the art of war, a change from the old conditions brought about mainly by the engineers. But it was not to be so. Cervera did not wait. He made his sally, was destroyed; Toral surrendered, and the war was over.

We have had our experience, which I hope will not be without value to each and all of us, and which I believe has taught some useful lessons. It is my deliberate judgment that engineers, including tradesmen, will make better soldiers than any other class of men, and by soldiers I mean all that the word implies; men trained in drill and marksmanship, able to care for themselves in the field, and to make long marches and to meet the enemy under all conditions, either offensively or defensively. The very nature of the training and daily life of carpenters, blacksmiths, plumbers, lumbermen, railroad men, steam engineers, electricians, masons, etc., is a preparation for the life of the soldier. Moreover, we found that many of these men who had no intention of volunteering in the ordinary State regiments, hastened to join an engineer regiment raised by the United States under a special act of Congress. This is another important fact which should not be forgotten.

I see in the papers that in the proposed increase of the army to 100,000 men provision is made for two engineer regiments. An army corps consists of three divisions, each division three brigades, each brigade three regiments, making twenty-seven regiments to each corps. One of these regiments should be composed of engineers; or, in other words, we should have at least four regiments of engineers instead of two with an army of 100,000 men. If Congress can be brought to see this necessity it will be of benefit to our country in the future.

And now, comrades, as to the future. Unless we form some association to perpetuate the memory of this regiment, it is doubtful if we ever come together again as we are to-night. The thought is a sad one. I doubt if there is any comradeship so lasting, so close, so binding as the comradeship of the tented field. It is sad to see this broken up. The regiment has practically disbanded now, and a few days more will see all the officers scattered to their homes. You have all stood loyally and obediently by me as your superior officer; your services have been exceptionally able, conscientious and efficient. I have tried to do my duty by you and by the regiment. And now I wish you all good bye, and God-speed in whatever walks of civil life fate may lead your steps.

Digitized by Google

Following Col. Griffin, Gen. C. G. Sawtelle responded to the toast "The President." "The Army" was represented by General W. F. Randolph, who made an eloquent address on the work of the soldiers in the war, and complimented the volunteer engineers. General A. S. Webb spoke of "The Veterans of the War." "The Volunteers in the War" was responded to by Lieut. W. M. Cruikshank, who was the officer who mustered in the engineers. Mr. C. A. Coffin spoke on "The Nation's Patriotic Women." Admiral Schley was to have responded to "Our Navy," and Frederic Remington to "War Correspondents," but neither was able to be present.

It is probable that, acting on Colonel Griffin's suggestion, there will be a permanent organization formed of the officers of the regiment, and that the dinner, which was so successful last week, will be repeated next year.

New York Electrical Society.

The 192d meeting of the society will be held at the College of the City of New York, Lexington avenue and Twenty-third street, on Wednesday, Dec. 14, at 8 p. m. Col. Eugene Griffin, Colonel of the First Regiment of U. S. Volunteer Engineers, and First Vice-President of the General Electric Company, will give an address on, "Ideas Underlying the Organization of the Volunteer Engineer Corps; the Work Accomplished by it in Puerto Rico, and the Opportunities of Further Usefulness." Mr. W. D. Weaver, late Chief Engineer of U. S. S. "Glacier," Editor of the "American Electrician," and Mr. F. W. Roller, late Chief Engineer U. S. S. "Nashville," will also address the Society on, "Electrical and Engineering Work in the Navy During the War." In this manner the relations of the engineering profession to both the Army and the Navy will be clearly brought before the members of the Society, and it is believed that the occasion will prove one of much general interest and value. The meeting is open to ladies.

LEGAL NOTES

Series-Parallel Controller Case.

Under date of Dec. 7, Judge Shipman of the U. S. Circuit Court of Appeals, Second Circuit, has filed his decision against the Nassau Electric R. R. Co., of Brooklyn, at the suit of the Electric Car Co. of America and the Thomson-Houston Elec. Co. The decision is in regard to the use of the series parallel controller, and is made under the Condict patent, No. 393323, the order of the Circuit Court being affirmed with costs.

PERSONAL

MR. HIRAM PERCY MAXIM, son of the distinguished inventor, and himself an electrical engineer of great ability, is to be married at Hagerstown, Md., on Dec. 21, to Miss Josephine Hamilton, daughter of Mrs. W. T. Hamilton. Mr. Maxim has of late been engaged in developing and perfecting the electrical vehicles of the Pope Mfg. Co., at Hartford, Conn.

W. H. WHITESIDE, of the Chicago office of the Westinghouse Electric & Manufacturing Co., has many friends who will be glad to know of the arrival of his first born, a boy, the evening before Thanksgiving, in time to be included in the list of good things to be thankful for.

MR. ERNEST WILSON, M. I. E. E., of London, has been appointed professor of electrical engineering at Kings College, to succeed the late Dr. John Hopkinson, who lost his life recently in the Alps.

MR. E. W. ROCKAFELLOW, of the Western Electric Company, New York, we are pleased to note, has returned to his duties after an absence of six months with the Forty-seventh Regiment, in which organization he was the captain of Company M. Mr. Rockafellow has been long identified in the trade in the capacity of salesman in the jobbing department of the Western Electric Company.

PRESIDENT C. W. HUNT'S thoughtful and suggestive address before the American Society of Mechanical Engineers has now been revised and issued in complete form. It can be obtained free on special application to Secretary Hutton, at the headquarters, 12 West Thirty-first street. We commend its perusal to all our readers.

MR. J. G. HICKCOX, of the Cutler-Hammer Mfg. Co., Chicago, is to be married on Dec. 21, at the Plymouth Church, Milwaukee, Wis., to Miss Claire Louise Whitcomb, daughter of Mr. and Mrs. Henry Franklin Whitcomb. We beg, with other friends, to extend our hearty congratulations and good wishes.

MR. JAMES ENGLISH, president of the New Haven Electric Company, and also of the Connecticut Electrical Association, has been so ill that the meeting of the Association has been postponed to December 17, by which time his friends hope he will be in his wonted health and spirits.

PROF. S. H. SHORT left on the "Majestic" on December 13 for a three months' stay in England and on the Continent. He is accompanied by Mrs. Short. This is the first holiday in many years, and has been well earned by notable contributions to the electrical art and industry.

THE STOCK MARKET

Everything Active and Strong.

Trade and other conditions during the past week have continued very bright, there being a large amount of business transacted at better prices. The early arrival of winter has done good to many lines, from overcoats to rubber shoes and all kinds of lighting and heating supplies. Railway earnings and bank clearings are still record breaking, and the various stock and produce exchanges throughout the country report securities and commodities as strong or advancing.

During the past week, Western Union on sales of 23,206 shares rose to 95½, the best price for some time past. General Electric was also very strong, reaching sales of 13,198 shares and the high figure of 89¾. New York Edison again went flying, and on sales of 3,172 shares reached 184¾, while Metropolitan Street Railway, on sales of 69,051 shares closed at 193¾. Wall Street talks freely of an impending deal in New York, to include all lighting and traction interests. In Boston, American Bell Telephone closed at 280, and West End Railway at 89.

Copper, New York, was quoted at 12.65 cents, and seems inclined to advance. The recent transactions in steel rail have cleared and steadied the market.

TRADE NOTES AND NOVELTIES

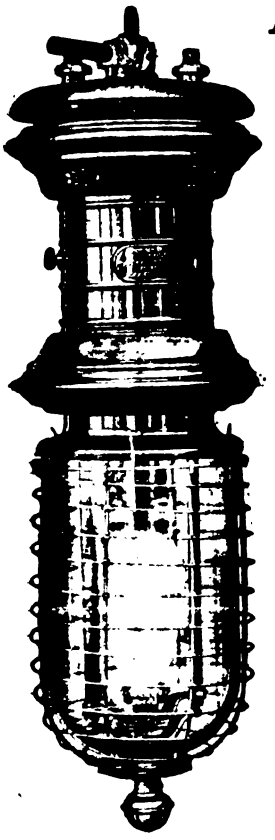
Recent Sales of Ridgway Dynamos and Engines.

We give below a list of the recent sales effected by the Ridgway Dynamo and Engine Company, of Ridgway, Pa.: Stineman Bros., South Fork, Pa., one 50 h. p. engine; Berwind-White Coal Mining Co., Windber, Pa., one 75 h. p. engine direct connected to 50 k. w. generator; the Summit Coal Co., Linton, Ind., one 175 h. p. engine; Bridger Coal Co., Wilsey, Mont., two 250 h. p. engines; Alpena Sulphite Fiber Co., Alpena, Mich., one 32 h. p. engine direct connected to 20 k. w. generator; Farmington Coal Co., Farmington, Ill., one 75 h. p. engine; Rush Run Coal and Coke Co., Rush Run, Va., one 240 h. p. engine; Nashville Abattoir Hide and Melting Association, Nashville, Tenn., one 50 h. p. engine direct connected to 30 k. w. generator; the Johnson Coal Co., Priceburg, Pa., one 360 h. p. engine; National Fertilizer Co., Nashville, Tenn., one 12 h. p. engine; Newtown

Digitized by Google

Electric Railway, Newtown, Pa., one 450 and one 225 h. p. engine; the Fred. W. Wolfe Co., Chicago, Ill., one 125 h. p. engine direct connected to 75 k. w. generator; Buffalo State Hospital, one 125 h. p. engine direct connected to 75 k. w. generator; Wallworth Construction & Supply Co., Boston, Mass., for the Worcester County Court House, one 85 h. p. engine direct connected to 50 k. w. generator; F. Bissell & Co., Toledo, Ohio, one 85 h. p. engine; Clarksdale Water and Light Co., Clarksdale, Miss., one 85 h. p. engine; Wheeling, Lake Erie and Pittsburg Coal Co., Dillonvale, Ohio, one 180 h. p. engine; J. F. Buchanan & Co., Philadelphia, for the U. S. Naval Station, Port Royal, S. C., two 125 h. p. compound engines and one 45 h. p. simple engine; Lake Lighting Co., Hammond, Ind., one 370 h. p. engine; M. R. Muckle, Jr., & Co., Philadelphia, three 60 k. w. direct connected generators, to be used by the United Gas Improvement Co., Philadelphia; William M. Barker, Deadwood, S. D., one 30 k. w. belted generator; Model Mill Co., Nashville, Tenn., one 20 k. w. belted generator; Greogery Central Station Co., Chicago, two 60 k. w. belted generators; University of Tennessee, Knoxville, Tenn., one 30 k. w. direct connected generator.

G. E. Marine Enclosed Arc Lamp.



ADEQUATE electric illumination of wharves, docks, warehouses, dry docks, ship yards, with their adjacent iron working shops, and the holds of vessels, while loading or discharging, demands a type of lamp somewhat different from that used for street or store lighting. It must be strong, compact and durable, or it will not withstand the hard usage which such service will naturally give it; it should give a large volume of clear, white light, which will not dazzle the eyes of the workmen nor throw heavy shadows in already secure corners; it should require little attention, and be so simple that it can be attended by an average lamp trimmer; lastly, it should require trimming not daily, but but only at long intervals.

The lamp which, perhaps, best meets these requirements is the marine enclosed arc lamp, manufactured by the General Electric Company. It has been made the object of special design to adapt it to marine usage on shipboard or land. The mechanism is compact, simple and reliable, and is protected from injury or the effects of the weather by a stout metal casing. It is only necessary to renew the upper or long carbon once in 100 to 150 hours; the lower carbon, after the first run, being the unburnt remainder of the upper carbon. With open arc lamps, it was necessary to renew the carbons daily. The outer globe shown as of clear glass in the illustration, is cylindrical in shape, of thick glass and protected from injury by a heavy wire guard. The globe can be lowered by a half turn of the thumbscrew at the side, and when pushed back in position is automatically and securely locked. The lamp is only 28 inches long. It can be carried from place to place if necessary, and hung by the metal ring at the top of any convenient hook, or may be permanently fixed in place like an ordinary arc lamp. The lamp can be used on a 110 volt circuit and can be adjusted for 4, 4.5, or 5 amperes, the latter being the standard.

Many of these marine lamps have been installed in locations such as those mentioned above, and have in every case given very satisfactory service.

OTTO GAS ENGINE WORKS, Philadelphia, Pa., have, they inform us, been awarded the gold medal at Omaha Exposition in competition with a number of different makers of gasoline engines.

Anchor Lock Push Button Switch.

TAMPERING with the switches in corridors of office buildings, asylums and other public institutions, where through ignorance or a wanton disregard for consequences, unauthorized parties frequently do considerable damage and cause much annoyance, has led to the adoption of precautions against such mischief. Locked cabinets are a successful means but are expensive to install and frequently inconvenient. Individual switch boxes with locks are expensive and unsightly, and under any circumstances cannot be used with push button switches, which are being used almost exclusively in the better class of public buildings.

The Anchor Electric Co. have therefore perfected their push button for this purpose by the addition of a simple attachment which permits the locking of the switch and will not allow its operation without a special key. The Anchor lock push button switch is uniform in size and appearance with the standard push button switch and can be mounted on a gang plate with standard push button switches where necessary. The compactness, the strength and the neat appearance of the Anchor device are sufficient to commend it to public favor.

Montauk Multiphase Cable in Boston.

The following report on the merits of the Montauk multiphase cable is published by permission of Mayor Josiah Quincy, of Boston, at whose request the officials of the Boston Fire Department made an official investigation:

Fire Department, Fire Alarm Branch.
Office of Supt., Bristol street.
Boston, Nov. 22, 1898.

To Col. Henry S. Russell, Fire Commissioner:

Sir—In compliance with your request I have examined the Montauk multiphase cable and hereby report that it appears to be a valuable adjunct for use in any automatic fire alarm service depending on the action of the thermostatic devices for its operation.

I base this opinion on the fact that the cable is so constructed that it is thermostatic throughout its entire length, and will therefore be available for operating the system with which it is connected should a fire occur at any point where it is placed.

On this account it is, in my opinion, superior to the isolated thermostats used in the present automatic systems. Respectfully submitted.

(Signed) B. S. FLANDERS, Supt.

Westinghouse-Parsons Steam Turbines for New York.

The Westinghouse Machine Company, with offices and works at East Pittsburg, have received contracts for what will probably be the largest steam turbine engines in the world. This order consists of three turbine engines of 500 horse power capacity each, to drive generators to be furnished by the Westinghouse Electric & Mfg. Company, for the replacement of a large number of steam engines at present used to drive the machinery of the air brake company at Wilmerding. The machine company are also constructing, under a rush order, a Parsons turbine engine, the first of five of 2,500 horse power each, to drive a 1,500 kilowatt multiphase generator for use by the United Electric Light & Power Company of New York City, which company will install it on a block of land adjacent to their new station, on Twenty-eighth street and East River. The capacity for this station has already been fully absorbed by the demand for electric light and power. These five new outfits, of an aggregate capacity of 12,500 horse power, will raise the Twenty-eighth street station capacity of the United Company to 20,000 horse power, and will leave available the site of the adjacent Twenty-ninth street station, the use of which has just been discontinued. An advantage from the use of these turbine engines and generators may be appreciated from the fact that the five engines and generators of aggregate capacity of 12,500 horse power can be placed in about one-half of the space now occupied by eight vertical engines of 1,200 horse power each with Westinghouse generators, now in operation at the Twenty-eighth street station.

Digitized by Google

Emerson Sewing Machine Motor.

The Emerson Electric Mfg. Co., of St. Louis, call attention to the fact that their improved induction sewing machine motor makes a useful and acceptable Christmas present for any housekeeper. These motors, having no wearing part except the shaft, are particularly adapted for use by inexperienced persons, and the entire device is easily attached to any make of family sewing machine. The sewing machine is started, stopped and speed is regulated by a slight movement of sewing machine treadle. They further state that this is not in any sense an experiment, but is thoroughly practicable, fully guaranteed, and sold at a low price. In order to fill orders promptly it is necessary to advise them of voltage and alternations of current, direction in which hand wheel of sewing machine revolves and style of plug for socket.

Lighting Christmas Store Windows.

The holiday season is upon us, the evening crowds upon the retail streets grow with each passing day, and more stores are open at night. Now is the time when the merchant, with brilliantly lighted show windows and artistically arranged displays, has the advantage. It is interesting and instructive to note the difference in effect between windows lighted in the ordinary way with incandescent lights in full view, and those lighted by the Frink store window reflector, where no lamps show, but where there is light in abundance. The comparison is unquestionably favorable to the Frink system, for exposed incandescents, by their greater brilliancy, distract the eye from the goods displayed, and often make it impossible to see them effectively. Oculists agree without exception that the source of light should be behind a person, or at his side, in order that an object may be seen with the least strain upon the eyes, and this cardinal principle is recognized in the Frink system. It consists of a hood-shaped reflector, running along the inside of the glass at the top of the window. Inside the reflector the incandescent lamps are placed. The shape of the reflector shields these lamps from outside view, and reflects all the light within the window. Coming thus from practically over the observer, the light falls full upon the objects before him, giving an effect obtainable by no other method of lighting. Full information concerning this reflector may be obtained by addressing I. P. Frink, 551 Pearl street, New York.

WESTERN NOTES

THE WESTERN ELECTRIC CO., New York, are pushing their metal shade hoods, reflectors, etc., and the department is quite active at the present time. The Western Electric Company carry an immense line of metal reflectors, hoods and fixtures, both for indoor and for outdoor work, many of which are so well known that they are a standard for this particular trade. The advertisements in the late and current issues of The Electrical Engineer show but a small portion of the great variety of these goods as sold by this concern. The wants of the trade have been constantly studied and closely followed for several years, and this has enabled the concern to furnish users with the greatest variety of labor-saving devices in this branch. They are now working upon some new appliances and designs which will be put on the market very shortly. The Western Electric Company will be pleased to mail their catalogue to any address upon application.

WESTERN ELECTRICAL SUPPLY CO., of St. Louis, Mo., are distributing throughout the West and South, a very neat and complete pocket catalogue, covering a complete line of Perkins-Gibbs switches. This book is very complete in itself and station managers and construction houses who have not received a copy will be furnished one upon application. They report very favorable sales on these switches, and carry a large and assorted stock in St. Louis.

ELECTRIC APPLIANCE CO. have taken the general Western agency for the well known Crescent tin shade. This shade has been designed with a view to displacing the ordinary flat tin shade, and it is being manufactured in such large quantities that it can be sold for even a less price than the flat shade. It is curved in shape to concentrate the light as much as possible, and has its bright surface corrugated to give a good distribution. It should certainly find a large field where the demand is for a durable and inexpensive shade or reflector.

WESTERN ELECTRIC CO., in order to promptly fill orders, now carries a complete stock of Stanley induction single-phase and two-phase motors. The former are made only in two sizes, viz., ¼ and ½ h. p., for either 50 or 100 volts and for 8,000 or 16,000 alternations. The two-phase motors (for either 8,000 or 16,000) range in sizes from 1 to 40 h. p. A complete stock of motor transformers is also carried. Full description and prices will be sent to those who are interested.

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, Mo., report some very flattering returns in their telephone department, having recently sold some complete exchanges in which their improved outfits were selected. They have recently made numerous changes in this department, and now claim to have as complete an outfit for modern exchanges as can be secured anywhere. They call particular attention to their express switchboard, which they claim is of the most modern type and very rapid in operation. They have also made numerous improvements in their 20th Century and Long Distance telephones, all of which are fully described in their new No. 18 catalogue, which is now ready for distribution, a copy of which may be had for the asking.

CONTENTS.

EDITORIALS:
Pious Founders 586
How to Develop Export Trade 586
An Electrified Navy 587
Electric Traction in a Storm 587
Consolidation and Cheaper Current 587
Treadmill Generators 587
ELECTRIC TRANSPORTATION:
Union Elevated Railroad Power House, Chicago (illustr.) 577
A New Riker Electric Delivery Wagon (illustr.) 578
Woods' Electric Moto-Vehicles (illustr.) 579
A Paris Underground Electric Road.—Extensive Connecticut Trolley Projects 580
POWER TRANSMISSION:
High Voltage Power Transmission.—IV. (Concluded) ..... Charles F. Scott. 580
Transmission at Denver.—Bridge Construction by Electricity 581
ELECTRO-CHEMISTRY
Electro-Chemical Operations in Europe (illustr.) 582
LITERATURE:
Clark's "Commercial Cuba" 585
TELEPHONY AND TELEGRAPHY:
The Coherer in Warfare With a Word on Balloons (illustr.) ..... Frank J. Sprague. 588
Telegraphy in Cuba and Porto Rico 588
Claims for Cutting Cuban Cables 589
ELECTRIC LIGHTING:
The Mechanical Plant of a Modern Office Building.—II. (illustr.) ..... Wm. H. Bryan. 589
The Long-Schattner Prepayment Meter (illustr.) 591
Brooklyn Edison Management 592
MUNICIPAL AFFAIRS:
Conference of the National Municipal League.—A Sweeping Municipal Programme at Haverhill, Mass. 592
Municipal Lighting Row in Berlin 593
MECHANICAL:
Data on the Efficiency of Electric Pumps (illustr.) 593
NEWS AND NOTES:
The Frazer Electric Elevator 585
The Paris Exposition of 1900 (illustr.) ..... Francis E. Drake. 594
Exports of Electrical Material from New York.—The Recent Big Fire in New York Sky Scrapers 599
Telephone Tolls in New York City.—Another Electrical Exhibition Next May 600
SOCIETY AND CLUB NOTES:
Dinner of the First Volunteer Engineer Regiment to Col. Eugene Griffin (illustr.) 600
New York Electrical Society 602
LEGAL NOTES:
Series Parallel Controller Case 602
PERSONAL:
Mr. Hiram Percy Maxim.—Mr. W. H. Whiteside.—Mr. Ernest Wilson.—Mr. E. W. Rockafellow.—Mr. C. W. Hunt.—Mr. J. G. Hickcox.—Mr. Jas. English.—Prof. S. H. Short 602
THE STOCK MARKET:
Everything Active and Strong 602
TRADE NOTES AND NOVELTIES:
Recent Sales of Ridgway Dynamos and Engines 602
G. E. Marine Enclosed Arc Lamp (illustr.).—Montauk Multiphase Cable in Boston.—Westinghouse-Parsons Steam Turbines for New York 603
Emerson Sewing Machine Motor.—Lighting Christmas Store Windows.—Western Notes 604

Department News Items will be found in advertising pages.

Digitized by Google

The Electrical Engineer.

Vol. XXVI. DECEMBER 22, 1898. No. 555.

ELECTRIC LIGHTING.

Festoons of Incandescents on Chicago Business Streets.

UNDOUBTEDLY the feature of the Peace Jubilee celebration in Chicago which attracted the most general attention was the illumination of the streets in the business portion of the city by festoons of incandescent lights. Through all the disagreeable weather that was Chicago's lot during that week of carnival, the myriads of electric lamps that were stretched canopy-like across the streets gave forth their cheerful light, in a great measure dispelling the gloom and to a greater extent perhaps than anything else giving the city a holiday air.

INCANDESCENT FESTOONS ON CHICAGO BUSINESS STREETS.

These festoons containing 7,000 lamps were hung or rather draped across the streets, being suspended in the middle by a cable drawn from one side of the street to the other. In every block four of these were hung, each festoon being switched separately and containing from 60 to 100 lamps, depending upon the width of the street. Over every lamp was fitted a little tin cup of the ordinary "drinking cup" variety, and as 7,000 of these were required, the manufacturer made them up specially, leaving off the handle. Two holes were punched in the bottom of the cup for the wires, and after these were drawn through, taped, and a little compound applied, the lamp with its "waterproof" was ready for use. How well these little tin cups costing but 1½ cents each, performed their function, may be judged from the fact that not a single lamp was lost by being short circuited, and the sockets when taken down were in such excellent condition that they were returned to stock at their original valuation, to be used again on regular fixture and drop-cord work. This simple and inexpensive method of making the ordinary Edison keyless socket waterproof, does away with the necessity of carrying in stock a large number of the regular weatherproof sockets, and what might oftentimes be of more importance, enables the lighting company to get up work of this sort for out-of-door use on short notice, as there are few, if any, manufacturers who carry as many weatherproof sockets in stock as would be required for much large work of this kind. In addition to the utility of this drinking cup, as a waterproof, it becomes at night a fine reflector; and in the sunlight, with the constant moving of the strings in the breeze, each cup appears like a silver fairy lamp.

A somewhat similar method of street lighting was attempted in London during the Queen's Jubilee, but owing to the use of material which would not stand the weather, it proved a complete failure. The same scheme—probably copied from Chicago—was put into effect in Philadelphia for their Peace Jubilee celebration and met with good success. The enterprising merchants of South Chicago and of Rockford, Ill., have inaugurated the same system of lighting for their main business thoroughfares during the month of December; the festoons in Rockford containing 1,200 lamps.

After the close of the Jubilee exercises in Chicago, a few of the leading business men on State street, recognizing the benefit to their street and to their business from this method of lighting, subscribed sufficient money to warrant the lighting com-

Digitized by Google

pany in continuing this service to the 2,400 lights on that street during the month of November. That this scheme of street lighting took with the public of Chicago is evidenced by the remarkable increase in the passenger traffic on State street during this month and (before the lighting of the street by the merchants was assured) by the hundreds of inquiries that were made of the lighting company by the public as to whether or not they were to have another opportunity of seeing State street lighted. These demands became so numerous that the Chicago Edison Company in self defence and at its own expense illuminated the street one night, the result being that the street was simply packed with people, and, as it is fair to presume that all did not see it that night, they undoubtedly availed themselves of the first opportunity they had after the lighting for the merchants began.

While all of these festoons in Chicago proper have now been taken down, there is no question that this scheme of street lighting, the credit for the first successful carrying out of which is due to the local Chicago company, is a great success, and we feel confident that the central station manager will find therein a means of disposing of his product at remunerative rates considering the time of day the load comes on, the hours of use and the small expense he must incur on account of the construction work.

Features of English Lighting and Power Station Practice.

WHEN one compares the plans and equipment of recently constructed English central stations and the construction of their lines and roads with those in operation and course of construction in this country, one is agreeably surprised to find a great similarity existing between the methods and systems used and the flattering adoption or adaptation of many of our practices by English engineers. American machinery has found a place in their central stations, and wherever installed have given satisfaction. It would, however, be unfair to say that nothing original has been infused into the design of English central stations and machinery. There are many features of merit, and to bring these out more prominently we note below four typical English stations, two furnishing current for lighting and two for railways.

THE GLASGOW RAILWAY POWER STATION.

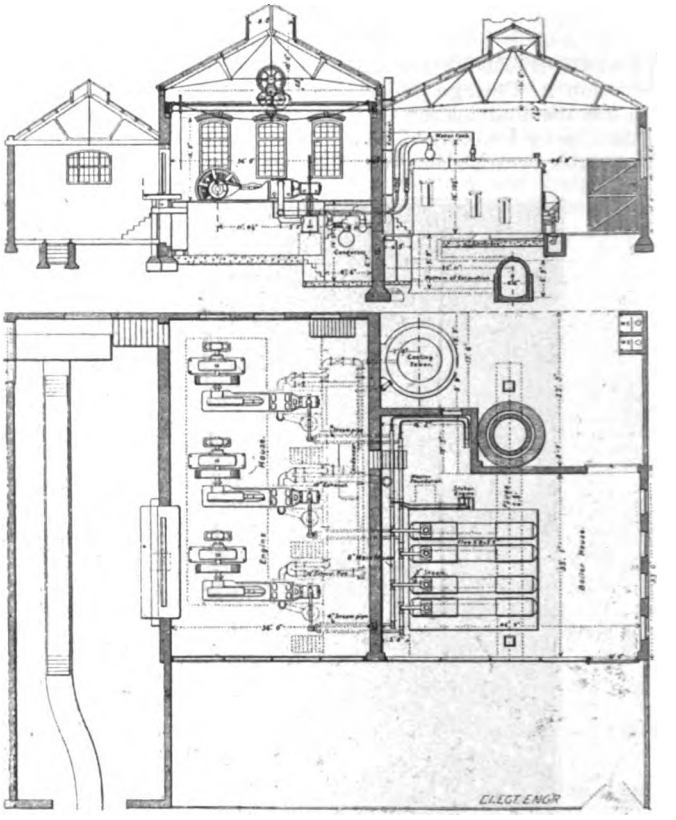
The Glasgow corporation which manages all the railways in that city has recently installed the overhead trolley on about 2½ miles of double track, and if this installation is found satisfactory the entire mileage will no doubt be converted to electric traction.

The situation of the power station was, to a large extent, predetermined by the fact that the corporation already had buildings used as stables near the Springburn terminus. Although not an ideal site for a station, in view of probable extension of the system, the location was not altogether disadvantageous, particularly as the city terminus is scarcely two miles away. The stables and car sheds have been remodeled, and now form a power station and car shed which, if not ambitious either in extent or appearance, are at least adequate for the purpose of trial which the corporation have immediately in view. The power station proper is a brick structure, with a temporary end wall of corrugated iron towards the street, there being room to extend the building in this direction.

Boilers.—In the boiler room are two Babcock & Wilcox water-tube boilers, having a capacity of 250 h. p. each, with a heating surface of 2,530 square feet, and a grate area of 51 square feet. The coal consumption per horse power is given as 2½ pounds, and about 10 pounds of water is evaporated per pound of coal. The fuel used is Scotch slack, and the stoking is done by Vicars' automatic stokers. Worthington condensers, and pumps by Blake and Knowles have been installed. The exhaust steam is led to a Worthington condenser with circulating water, which is cooled in a Worthington cooling tower. There is also a convenient arrangement for exhausting to the atmosphere when required. All steam piping is in duplicate. Water, both for boilers and condensers, is taken from the corporation supply, which is obtained from Loch Katrine.

Engines.—In the engine room, which measures 61 feet by 30 feet by 34 feet in height, there are three McIntosh & Seymour compound tandem engines, supplied by Messrs. R. W. Blackwell & Co. These engines have 24 inch stroke with cylinders 11 inches and 22 inches in diameter, and run at a speed of 200 revolutions per minute. They are of the makers' usual type for electric railway service, and are provided with a fly wheel, governor acting on the expansion valves of both cylinders. Their efficiency is 90 per cent. The engines are erected on concrete foundations, extending down to the floor of the basement in which the steam pipes are placed.

Generators.—Each engine is coupled direct to a 200 k. w. (380 amperes at 550 volts) generator. These generators have eight poles and drum-wound armatures, and are of the Westinghouse Co.'s standard type. Their efficiency is 94 per cent. The test required was that the machines should be run continuously for 24 hours at full load, and then for one-half hour at 50 per cent overload. The combined efficiency of engine and generator is given at 85 per cent.



PLAN AND SECTION OF POWER STATION AND ONE CAR REPAIRING SHED, SPRINGBURN RAILWAY, GLASGOW, SCOTLAND.

Switchboard.—The switchboard, which has been supplied by the Westinghouse Co., has been erected in a recess in the wall adjoining the car repairing shed. A gallery has been constructed behind it, extending into the car shed, so that there is ample space for inspection. The switchboard consists of eight panels, including three feeder panels, two Board of Trade panels, and three machine panels, each provided with testing and measuring instruments and switches.

Car Sheds.—Adjacent to the power station are eight car sheds, one of which is shown with the plan of the station. Each shed measures 90 feet in length and 27 feet in width, and there are, in all, 15 tracks having a total length of 415 yards. Ten of the tracks have been provided with pits for inspection and repair.

LLANDUDNO MUNICIPAL ELECTRIC SUPPLY WORKS.

A very interesting and in many ways, unique plant, has recently been completed at the fashionable North Wales watering place, Llandudno, for supplying current to the numerous hotels and boarding houses, and in all probability to the electric railway which, in a short time, will run through that town. The plant is of special interest as it has been designed to work in conjunction with a refuse destructor plant, although it is not intended that the generation of steam shall depend entirely upon refuse destruction. There are three Babcock & Wilcox boilers, two of which are fired from Messrs. Beaman & Deas' destruc-

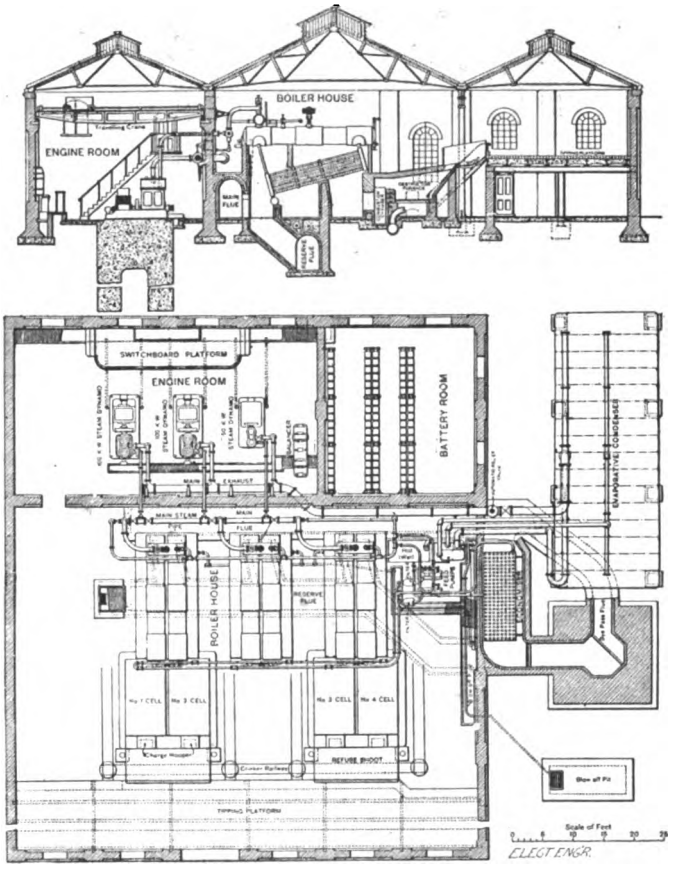
Digitized by Google

tors, the third being arranged only for hand firing, but all three boilers can be fired with coal or coke by hand if required. The location of the station close to the gas works enables coke fuel to be obtained cheaply and conveniently by both the electric light and gas departments, thus reducing the costs of these municipal undertakings.

The Beaman & Deas' refuse destructor is one of the most modern and generally used form of destructor, and has already been erected at numerous works throughout the United Kingdom. The general arrangement of the destructor relatively to the boiler plant is shown in the accompanying longitudinal section of the works. The refuse is carted up an incline to the tipping platform, and tipped direct into the mouth of a hopper about 18 inches square, from which it falls down to a firebrick hearth carried on T irons, the hearth being set at an inclination of 52 degrees. Falling from this the refuse rests upon a fire grate of about 5 square feet area, the fire-bars of which are of the ordinary stationary type with spaces of about 3-32 inch, allowing fine ash to pass through. The gases pass over a firebrick bridge into a combustion chamber whence they pass through a short flue to the front lowermost flue of the Babcock boiler, and then take the usual course through the tube stack to the main flue leading to the economizer. The Babcock-Wilcox boilers each have 1,741 square feet of heating surface, and 36½ square feet of grate area. Each is constructed in seven sections, each section containing seven tubes 16 feet in length; and there are two steam and water drums 36 inches in diameter in each boiler. The boilers work at 150 pounds pressure, and are each capable of evaporating 5,000 pounds of water per hour. In conjunction with the boiler plant there is a furnace economizer by Messrs. E. Green & Son, consisting of 192 pipes arranged in one group, fitted with deflectors at the back. Adjoining the economizer in the boiler house is a small recess used as a pump room, which is equipped with steam feed pumps by the Blake-Knowles Steam Pump Works, of the type used in connection with the Belfast municipal electric supply works, described below. Immediately outside the boiler room a Ledward evaporative condenser is being erected. This, when completed, will be capable of condensing 7,500 pounds of steam per hour. The condenser is of the usual tubular type, and is erected over a large cast-iron tank, having a capacity of 4,000 gallons. The air and circulating pumps for the condensing plant are driven direct by a vertical compound engine, this portion of the plant having been built and erected by the Sunderland Forge Co.

The engine room may be entered from the boiler room, and is on the same level. It is at present equipped with two 100 k. w. steam dynamos and one 50 k. w. steam dynamo, together with a motor generator for regulation and for charging the batteries. The generating sets were supplied under the contract of the India Rubber, Gutta Percha and Telegraph Works (Ltd.), and comprise two Belliss compound two-crank self-lubricating engines of their E. C. 7 standard pattern, each direct-coupled to a "Silvertown" S. D. 220 single horseshoe undertype dynamo with drum-bar armature, each set giving an output of 100 k. w. at 440 to 500 volts when running at a speed of 450 revs. per minute, and supplied with steam at 140 pounds pressure, the engines being arranged to exhaust either into a condenser or to the atmosphere. There is also a third generating set composed of a Belliss E. C. 4-type engine coupled to a "Silvertown" single horseshoe undertype dynamo with Gramme-wound armature, and capable of giving an output of 50 k. w. at 600 volts when running at a speed of 550 revs. per minute. A balancer is provided consisting of two machines mounted on the same bedplate and coupled together, each armature being capable of carrying a current of 100 amperes and working at a voltage varying between 220 and 256 volts, so that it can transfer 25 k. w. from one side of the three-wire system to the other. These machines are also single horseshoe undertype machines with drum-bar armature, and run at 1,000 revs. per minute. A small motor has also been fitted for driving the scraper gear of the Green economizer. Traversing the engine room, there is a small 25 foot span hand-traveler capable of lifting 5 tons, with a vertical lift of 18 feet. This traveler was erected by the Sunderland Forge Co.

The switchboard in the engine room is very conveniently erected on a low platform facing the engine sets. It was constructed and equipped by Mr. James White, of Glasgow, and is built on a steel frame erected about 3 feet from the wall. It consists of 14 polished white marble panels screwed to the framework. The left panels serve as a dynamo section, the middle the balancing section, and the right panels a feeder section. The spaces between the panels are filled in with polished teak wood moulding, and surmounting the board is an ornamental frame carrying a self-winding clock, also the feeder and dynamo voltmeters. The back of the switchboard is enclosed, being reached through panel teak wood doors at the sides. Each dynamo panel is fitted with a Kelvin sector pattern ampere gauge, a maximum automatic cut-out and a double-pole change-over switch of the multiple contact knife pattern. Below each of the dynamo panels are the field regulators, the resistances in connection with which are fitted on the wall behind the board. At the top of the middle panel are fitted Kelvin recording voltmeters and two recording ammeters, while below these are the balancing ampere gauges and motor starting and field regulating



PLAN AND TRANSVERSE SECTION OF THE LLANDUDNO MUNICIPAL ELECTRIC SUPPLY WORKS.

switches. On the lower middle panel the voltmeter double-pole switches are fitted, while on each of the feeder panels there are mounted two Kelvin sector pattern ampere gauges, one on the positive and one on the negative section, the feeder fuses being mounted directly behind these.

The battery switchboard is mounted on a steel frame in a similar manner to the main board, and carries three polished marble panels. Two of these are provided with regulators for the 30 regulating cells of each of the two batteries, and on the top panel are mounted two Kelvin engine-room voltmeters connected between the middle of each of the "charge" bars of the battery. We may here say that the connections in the battery room from the regulating cells to the regulating board are of copper rod protected with anti-sulphuric enamel, the rods being carried on porcelain insulators fitted on wooden beams supported from the roof.

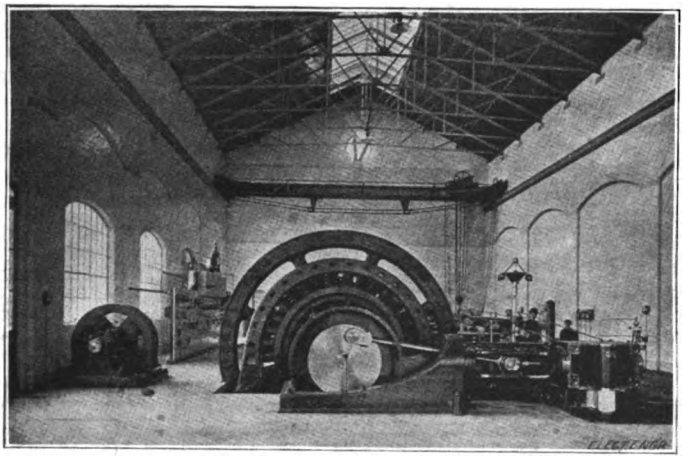
The battery room is reached from outside the building, and is a spacious apartment capable of holding considerably more cells than are at present erected. It now contains two batteries for the three-wire system, each battery consisting of 120 cells of 19 plates, in glass boxes, the output being 50 amperes for 10 hours, or 200 amperes for one hour. The batteries are of the usual type manufactured by Messrs. Pritchetts & Gold, by whom they were supplied for this station.

Digitized by Google

Mr. A. H. Preece was the consulting engineer, and Mr. H. Morton the resident engineer of the company. We are indebted to the "Electrician," London, for the above details and illustration.

THE MIDDLESBROUGH, STOCKTON & THORNABY ELECTRIC RAILWAY.

An interurban railway which can claim many distinguishing features, but is based largely upon American practice, is the one connecting the towns of Middlesbrough, Stockton and Thornaby. It was indeed a rare compliment which was paid to



INTERIOR OF ENGINE ROOM, MIDDLESBROUGH, STOCKTON & THORNABY ELECTRIC RAILWAY.

the engineers by Major Cardew after official inspection, who said he had never seen a more perfect installation. The system at present consists of 8.5 miles of railway, comprising 15 miles of track.

The main power station is situated on the River Tees, at Stockton, close to Victoria Bridge, and about 2.5 miles from Norton and 4 miles from the terminus at Middlesbrough. A wharf has been constructed on the river with a frontage of 200 feet, so that coal can be conveniently received. An electric crane erected on the wharf is used in discharging vessels, the coal being first put into a hopper and weighed in three ton lots. It is then automatically hoisted and discharged by a lift into storage bunkers, from which it is fed by gravity into the hoppers of the mechanical stokers. About the centre of the wharf a cast-iron cased sump with cut-off valves has been laid down for supplying the condensing plant.

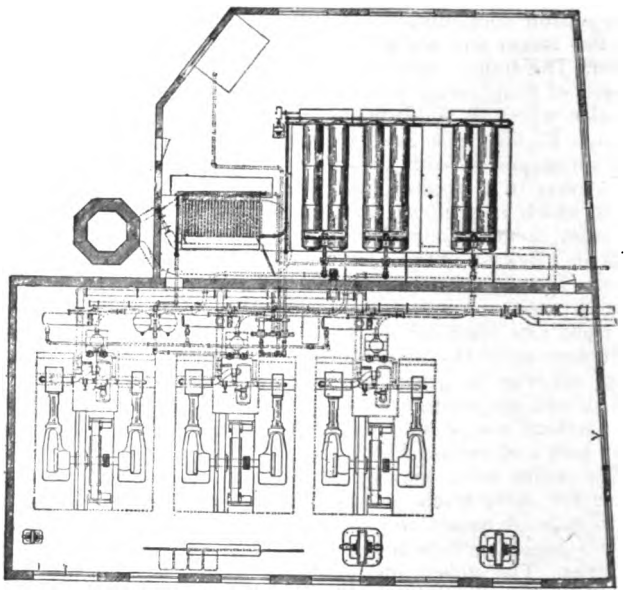
A plan and section of the engine and boiler rooms is given in the figure. The walls of all the station buildings are constructed of brick, and are faced with red pressed brick.

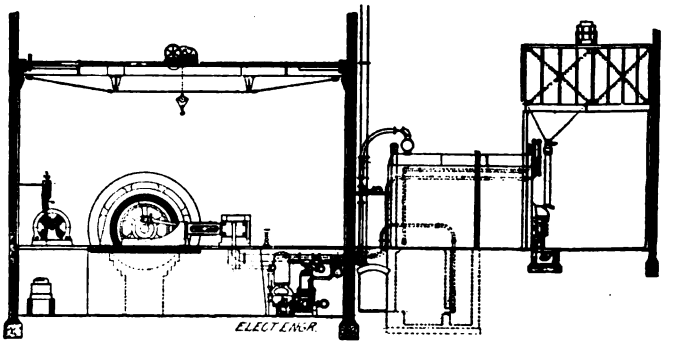
Boilers and Accessories.—The steam generating plant occupies a room measuring 78 feet by 48 feet 6 inches, with a height of 36 feet from the floor to the tie bars of the roof. Here are three Babcock & Wilcox water tube boilers, each having a heating surface of 3,580 square feet, and capable of evaporating 12,000 pounds of water per hour. The steam and water drums are 22 inches in diameter and 23 feet 7 inches in length; the cross drum is 24 inches in diameter and 7 feet 6 inches in length, and carries an 8 inch stop valve. Each boiler furnace is provided with a Vicars' mechanical stoker worked by an electric motor, and coal is fed to the stokers by gravity from the steel storage bunkers supported on steel columns and occupying the upper part of the station. The capacity of the bunkers is about 300 tons. The conveyor carrying coal from the receiving hoppers to the bunkers is capable of handling 20 tons per hour. In the boiler room is a Green economizer of 240 tubes. This is in conection with a smokestack placed in an angle between boiler and engine room. The stack is 132 feet high and 7 feet in diameter at the top. It is octagonal, built of pressed brick, and is lined with firebrick. The boiler room also contains a feed tank.

Engines and Condensers.—Adjacent to the boiler room and communicating with it by two doors is a spacious and lofty engine room, with interior walls faced with glazed bricks. Panels and string courses are marked with blue glazed bricks and over the arched panels is a cornice carried the entire length of the engine room on which runs a ten ton traveling crane. The engine room measures 110 feet by 52 feet, and has an open roof consisting of iron principals with varnished and grooved boarding, the outside being covered with blue Welsh slates. The floor of the engine room, beneath which is a basement, is supported upon iron girders with boiler plates between, concreted to floor level and finished with marble mosaic tiles. There are at present three engine foundations of solid concrete built up from the level of the basement floor.

The engine plant consists of three Reynolds-Corliss slow-speed horizontal cross-compound condensing engines of 400 h. p. each, constructed by the E. P. Allis Co., of Milwaukee. This is the first instance of the use of the Allis engine in England, but there will shortly be another example in the installation of the Central London Railway, where six engines of 1,300 h. p. each will be used. In the engines at Stockton the high pressure cylinder is 16 inches in diameter and the low pressure 32 inches in diameter, the stroke being 36 inches. Each engine runs at 94 revs. per minute, and is directly connected to a 300 k. w. three-phase generator.

The condensing and pumping plant is arranged in the basement, and all steam condenser, suction and other pipes and connections, are carried below the floor, clear space being thus secured around the generating units. Wheeler condensers are provided for each engine, and there is a supplementary exhaust





PLAN AND TRANSVERSE SECTION OF ENGINE AND BOILER ROOMS, MIDDLESBROUGH, STOCKTON & THORNABY ELECTRIC RAILWAY.

atmospheric pipe into which the exhaust from any engine may be turned if desired.

The boiler feed pumps, of which there are two, have steam cylinders 7½ inches in diameter, with 6 inch stroke, and pump cylinders 4½ inches in diameter. The suction pipe is 14 inches and the discharge 13 inches.

Generators.—As mentioned above, each engine is directly connected to a three-phase dynamo of 300 k. w. capacity. Thus the total capacity of the station is 900 k. w. No direct current generators are used. Each of the three generators is of the three-phase type, having 32 poles, giving 2,500 volts with a frequency of 25 cycles at 94 revs. per minute. The fields are

Digitized by Google

independently excited, and current for this purpose is taken from the 500 volt bus-bars. To supply this current in the morning for starting the dynamos, and for lighting the station, a battery of accumulators has been provided. These are placed in a separate building adjacent to the car shed.

The three-phase generators have a magnet frame of cast-iron with laminated sheet iron pole pieces, bolted together, and cast into the yoke. The field coils are wound on sheet iron spools with brass flanges, the coils being insulated from the sheet iron with paper, and from the brass flanges with wooden rings, capable of standing a puncture test of 5,000 volts. The armature core is built up of sheet iron laminations .014 inch thick, with rectangular slots punched in their periphery to receive the windings. The punchings are fastened to a spider by bell-tailed projections on their inner circumference, which fit on to the corresponding slots on the outer circumference of the armature spider. Ventilating spaces are arranged at intervals between the laminations, so as to allow of a free circulation of air in immediate contact with the core and windings. The armature spider is of cast-iron in one piece, consisting of a hub with outwardly projecting spokes supporting the punchings. The hub is pressed down and keyed to the engine shaft. The winding of the armature consists of 48 coils mounted on formers, and insulated to withstand 8,000 volts. The portions of the coils which project beyond the core on each side are arranged in two layers, thus furnishing ample space for insulation, and rendering it possible to remove one-half of the coils without disturbing any of the rest. Any of the other coils can be removed by taking out the two adjacent coils. The approximate weight of the armature is 14,500 pounds, and of the fields 27,000 pounds.

The system of distributing power to the trolley lines is, it will be seen, somewhat novel. Although the potential required on the trolley line is 500 volts, all current is generated at 2,500 volts alternating, and then transformed and converted to 500 volts direct current at the main station, and at a sub-station, nearly three miles from the main station.

Switchboards.—The generating station contains a switchboard made up of 14 panels of polished white marble, having a total length over all of 21 feet 4 inches, and a height of 10 feet 3 inches. The various panels are as follows: one boosting rotary converter panel, one battery panel, three transformer panels, three generator panels, two high tension feeder panels, two rotary converter panels, one line feeder panel, one Board of Trade panel. The switchboard at the sub-station is similar in construction to that at the generating station.

Transformers and Rotary Converters.—Thomson-Houston transformers and rotary converters are employed at both stations. In the engine room at the main station there are two rotary converters which have been used in preference to motor generators, on account of their high efficiency and ease of manipulation. They consist essentially of direct current generators to the armature windings of which connections are made at suitable points to a set of three collector rings on the end of the shaft opposite that occupied by the commutator. The three-phase current is led into these collector rings, and the machine is run at the current speed for 25 cycles. The same winding thus serves for the current led into the machine, and the direct current taken out. The "step-down" transformers reduce the current generated by the three-phase machine at 2,500 volts to 320 volts, so as to obtain on the commutator side of the rotary direct current at 500 volts. At the main station there are two four-pole rotary converters of 200 k. w. capacity, running at 750 revs. per minute. These take the current from the transformers, and, after conversion, transmit it direct into that part of the tramway system which is fed from the main station. This includes the lines for two miles on either side of the central station. The trolley lines are divided in the usual manner by section insulators into half-mile lengths, and current is fed in at section boxes at these intervals.

From the main station to the sub-station at Newport the 2,500 volt three-phase current is transmitted by two three-core cables, in each of which are three conductors of copper suitably insulated; each conductor has an area of .0775 square inches. With this small section it is possible to transmit 300 k. w. with a loss of only five per cent.

At the sub-station at Newport there are transformers and three rotary converters, which perform the same office as those at the main station, receiving alternating current at 2,500 volts, and reducing and converting it to 500 volt direct current.

Into the reasons which led to the adoption of the method of distribution just described, we cannot here enter in detail, but the more important were the position which it was desired to give to the central station, the length of the line, and the regulations of the Board of Trade as to the earth return. It will be remembered that the difference of potential between the generating station and the extreme ends of the tramways must not exceed seven volts, and there was reason to anticipate that if current had been supplied at 500 volts direct from Stockton the drop in the earth return, between the station and the termini at Linthorpe and North Ormesby, might have exceeded the prescribed limit. Consequently the three-phase high potential system was adopted, and a sub-station was placed at Newport Road, thus giving two points of distribution. With this arrangement the current along the line may be in opposite directions at different times, according to the distribution of the load, and thus practically, all risk of electrolysis of gas and water pipes is avoided. Besides this consideration, the system adopted has the important advantage of requiring a much smaller amount of copper in the feeders than would be necessary with the more common mode of direct distribution.

Accumulators.—As already mentioned, a battery of 260 cells, made by the Tudor Company, has been placed in an accumulator room adjacent to the station. The cells have a discharge rate of 48 to 70 amperes, the capacity at the lower rate being 240 ampere hours.

The battery supplies current for starting the dynamos in the morning and for lighting the station, and a combination of static and rotary transformers for charging the batteries is a novel feature in the station equipment. The charging current is taken from a bus-bar receiving current from the rotaries at 500 volts. It is then passed through a booster which consists of a rotary converter fed from step-down transformers. The transformer was designed with a large amount of leakage between the primary and secondary, the leakage being so adjusted that by changing the phase of the armature current by variation of the field current of the booster, the transformer ratio is varied and consequently the voltage on the collector rings. In this way it is possible to vary the voltage on the continuous current side of the rotary from 40 volts to 150 volts, thus raising the voltage of the current from the 500 volt bus-bar to 650 volts. The charging current is 60 amperes, and the armature of the rotary is designed to carry this current continuously.

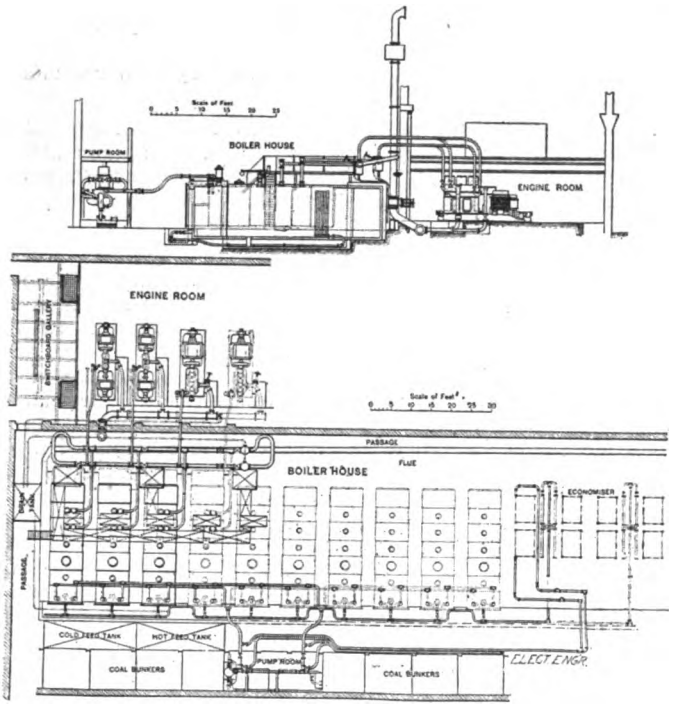
For the above details and illustrations we are indebted to the "Railway World," of London.

THE BELFAST MUNICIPAL ELECTRIC SUPPLY WORKS.

A few years ago the experiment was tried by the municipality of Belfast of using gas engines as prime movers in a central station; and while it cannot be called a failure, it has demonstrated that in one case at least gas power is not the best suited for wholesale electrical supply over an extensive area. For this reason a new station has just been erected equipped with the most modern machinery, and it is the intention to have the old gas plant serve for auxiliary supply in conjunction with the new station, which, although on the boundary of the present area of supply, is very centrally situated as regards Belfast as a whole, and will ultimately become a true central station. It is very conveniently situated on the River Lagan, enabling a condensing plant to be used without difficulty, and facilitating supplies of fuel and materials. The ultimate capacity of the buildings that can be erected on the land acquired for the purposes of this station is 20,000 h. p., but the present buildings are capable of housing only 10,000 h. p., the land extending beyond the chimney stack being as yet unbuilt upon. The present pile of buildings possesses considerable artistic merit. It was designed by the architects, Messrs. Graeme-Watt and Tulloch, and is situated between East Bridge street and the river. The principal facade, which is towards the street just named, is in the style of the English renaissance, and is constructed in red brick and Giffnock stone. Owing to the soft and marshy nature of the subsoil at Belfast, the buildings have been erected on piles, no less than 1,200 having been driven for the building and 154 for the chimney stack, which is 175 feet in height and has a diameter at the base of 25 feet, the internal diameter of the flue being 13 feet. The buildings throughout are of fireproof construction, the floors being of concrete and steel. The paving of the battery room floor is of vitrified tiles embedded in cement, the joints being afterwards run with pitch,

Digitized by Google

this having been found to serve best for the purposes of a battery room. The ground floor is occupied by the engine house, the boiler house and accessories, the battery room and various offices. The boiler house and engine house are each 200 feet in length, the latter being 64 feet wide and the former 40 feet wide. Both are very spacious, lofty and well lighted, the roof in each being carried by light steel ties. When completely equipped, the present boiler house will contain ten Lancashire boilers, each 30 feet in length by 8 feet diameter, but three only are at present erected and a fourth is being put in. Two of these boilers are fitted with mechanical stokers of the Bennis and Proctor types, and the third is at present arranged for hand-firing. By this arrangement the relative merits of hand-firing and the various systems of mechanical stoking can be carefully watched by the chief engineer, and the decision ultimately arrived at as to which is the best adapted to local conditions. Welsh small



ELEVATION AND PLAN OF THE BELFAST NEW ELECTRIC SUPPLY WORKS.

coal is usually burned, and for this the well-known mechanical stokers of Messrs. Bennis & Co., of Bolton, are well suited. Indeed, when the advantages of mechanical stoking in point of smokeless combustion and improved steam production are taken into account, it is not surprising to find that stations are rarely, if ever, now built without them, while in many older stations where hand-firing has been practiced mechanical stokers are being introduced. At the end of the boiler room there is a Green economizer, consisting of 216 tubes, the scrapers of which are worked by a small electric motor. The coal bunkers extend along the length of the boiler house, and are arranged so that they can be worked with spiral conveyors and elevators for feeding the mechanical stoker hoppers. At present these hoppers are filled by hand. The pump room adjoins the boiler house, and is extremely well arranged. It is equipped with steam and electrically driven pumps, built by the Blake & Knowles Steam Pump Works, arranged on a duplicate feed-water system, the pipes being so designed that the feed can take place either through the economizer or direct to the boilers. The motors were built by the Electric Construction Co., and are geared by spur gearing to the pump spindles, forming a compact and efficient arrangement. In addition to the electric pumps, there are two sets of horizontal duplicate steam pumps capable of delivering 4,000 gallons per hour. These are provided with duplicated steam mains. The pumps are of the Blake improved type with their patented improved outside valve motion, by which the full length of the stroke of the pump can be secured while working against the heaviest pressures. By this external arrangement the piston is enabled to travel from end to end of the cylinder and so obviate the steam clearance spaces which are incidental to a pump of the usual duplex type. These pumps are guaranteed to be at least 25 per cent. more economical in steam consumption than the duplex pump with the ordinary valve motion. Cushioning valves are also provided so as to insure the utmost steadiness in running. The pump room also is equipped with a Kennedy water meter and an oil filter. Returning to the boiler room, we may note that each boiler, which works at 180 pounds pressure and has been tested to 270 pounds, feeds steam into a duplicate system of steam mains, carried by tie rods from brackets fixed in the walls or suspended from the roof. The connections to each engine consist of a Y piece provided with stop valves, and the boilers have two junction valves with a 5-inch branch to each main. The steam ranges are of lap-welded mild steel, the flanges of wrought steel being welded on. Copper expansion bends are provided to allow for changes in length. Each boiler has three safety valves, and the valve equipment throughout is on the Hopkinson patent parallel slide principle.

The present equipment of the engine house consists of three sets of continuous-current steam dynamos, the steam engines being built by Messrs. G. E. Belliss & Co. and the dynamos by Messrs. Thomas Parker, Limited. A fourth set is in course of erection. Two of the Belliss-Parker sets consist each of a Belliss engine placed between two 50 k. w. balancing dynamos direct-coupled on one shaft. These run at a speed 380 revs. per minute, and have a varying voltage of from 220 to 350 volts. The larger set consists of a single three-crank engine, coupled direct to a 200 k. w. continuous-current dynamo, capable of delivering from 440 to 500 volts. When worked at the higher pressure of 500 volts, these generators might conveniently be used for driving electric tramways on the trolley system, but at present there is no definite scheme of electric traction in Belfast.

In addition to the generating sets, the engine house is at present equipped with motor generators and boosters on the Crompton principle, these being used either for balancing on the three-wire mains for boosting the feeders, or for charging the cells.

At one end of the machinery room there is a spacious and well-equipped switchboard gallery, from which a splendid view of the machinery room can be obtained. On this gallery Messrs. J. H. Holmes & Co. have built one of the best and most convenient forms of switchboard that we have ever met with. Not the least important feature of it is the admirable way in which the back connections of the board are carried out. The board is at present equipped for six feeders, eight generators, and the boosters, motors, generators and three-wire batteries. The panels are of enameled slate, 7 feet 6 inches high, the width varying from 2 feet 8 inches to 3 feet 3 inches. The framework of the switchboard is of steel, with teak mouldings between the panels. A novel feature of the switching arrangements is the introduction of mechanical gear in place of electrically connecting the wires for the regulating resistances, etc. Immediately in front of the switchboard are a number of regulator wheels, supported on iron pillars. These do not directly actuate the electrical contacts controlling the regulating resistances, but operate a system of connecting rods and bevel gearing, by which contact-pieces, at some distance from the board and in a place of greater security than on the board, are efficiently controlled. A similar method of control is in use for the regulator end cells of the battery, for the purpose of regulating the battery pressure in charging and discharging.

The battery room is on the lower level immediately behind the switchboard, and controlling shafts, operated from the switchboard, pass down through the floor to the regulating switch on the battery room wall. The battery room is at present only equipped with one-half of its possible storage capacity, viz., with two batteries each of 130 E. P. S. cells of the Faure-King type. The normal capacity of these cells is 500 ampere-hours for five hours, but they are capable of developing 300 amperes for one hour's discharge. The arrangements for milking up the cells are the most perfect we have ever seen, both mechanically and electrically. Overhead, throughout the battery room, are a number of movable contact connectors, by means of which any cell may be milked from the hospital cells. We may here say that the ingenious but apparently impracticable system of telescoping the electrical connections of batteries for the purposes of regulation has been abandoned. This method was introduced by Prof. Ken-

Digitized by Google

nedy into the old station, but it has been found that the irregularity of charging and discharging the overlapping cells, and the difficulty of coping with this, is more marked in such an arrangement than with the ordinary end connector contacts. At present there are 45 end cells on each battery, these being, in each case, at the middle wire or inner end of the battery. Thus 90 cells in series are regulator cells, and by an ingenious arrangement Mr. McCowen has succeeded, by means of a local circuit in charging these independently of the other cells in the battery, the charging being effected from one of the motor-generators running at a low pressure. While the two main batteries, therefore, are working on the feeders or general supply, the out-of-use regulator cells may be charged up to their proper limit. This arrangement is found to work much more smoothly and satisfactorily than the telescope system. The above details and illustration appeared in "The Electrician," London.

The Mechanical Plant of a Modern Commercial Building.—III.[1]

BY WILLIAM H. BRYAN, St. Louis, Mo.
(Member of the Society.)

AT the time this work was taken up the 220-volt arc lamp was in an experimental stage. It was a question whether to burn the arcs singly across 220 volts, or to use two 110-volt lamps in series. In either case, the enclosed arc lamp, burning in multiple, was to be used, for reasons explained later. A large number of sample 220-volt arc lamps were tested in the offices of the engineers, and a reasonable number of these were found satisfactory. The arc is long, and the light has a bluish purple tinge. The former, however, was not objectionable with the ground-glass inner globe. The latter also yields to treatment; so that, on the whole, it was thought entirely safe to use the single lamp, thus greatly simplifying the system.

The electric elevators could, of course, have been operated alone with less than 75-kilowatt average; 75 horse power, or 56 kilowatts, being the average amount of energy required, as already explained. As electric elevator service, however, is frequently subject to sudden and severe overloads for short periods, due to the starting and operating of a number of loaded elevators simultaneously, a surplus of power was necessary; and as it was desirable to have all the electrical units alike, and interchangeable, it was thought best not to reduce the size of the third unit.

The specifications provided that the generators should be of the direct-connected type, mounted on engines, each generator to be rated at 75 kilowatts at 220 volts. Speed about 250 revolutions per minute. When run continuously at rated load, the temperature was not to rise more than the following amounts above the surrounding air: 72 degrees Fahr. in the armature; 54 degrees in the fields; 72 degrees in the commutator. They were to be capable of carrying 25 per cent. overload for two hours, and 33⅓ for one hour, without excessive heating anywhere, and without injurious sparking at the brushes. They were to be capable of taking 50 per cent. overload momentarily, without flashing or injurious sparking, and were not to flash around the commutator when the circuit breaker opened at 50 per cent. overload. They were to run without sparking or shifting of the brushes from no load to 25 per cent. overload.

These rather rigid requirements were due to the possible operation of electric elevators, and as several prominent builders were in a position to supply such machines, competition was not limited.

The winding of the fields was over-compounded to give 3 per cent. higher voltage at the brushes at full load than at one-tenth load. The rise in voltage was to be proportional to the load throughout. The current density at rating in the copper brushes was not to exceed 27 amperes per square inch of brush contact. The insulation resistance between any conductor and the frame of dynamo was to be at least one megohm.

The switchboard (Fig. 2) was to be of white Italian marble, 1½ inches thick, located 24 inches from wall. There was to be a generating panel for each dynamo, containing one fireproof field rheostat, one double-pole double-throw knife switch, one single-pole magnetic circuit breaker, one pilot lamp, one Weston ampere meter, the necessary bus-bars, one round pattern Weston 250-volt voltmeter, with switches to connect it with the terminals of each dynamo; with bus-bars, with the distributing circuits, with positive bus-bar and ground, and with negative bus-bar and ground. There were to be two feeder panels, containing one 1,200-ampere double-pole double-throw switch, ten 150 and four 50-ampere double-pole double-throw knife switches with fuses, and one lamp ground detector. Each feeder panel was to have a neat goose-neck bracket light, with shade and holder. The conductors were to be proportioned so that the temperature would never rise more than 45 degrees Fahr. above the surrounding air. Each circuit on the board was to be lettered or numbered.

This board is designed with an extra power bus-bar, so that the elevators can be operated separately from the lights, if desired. This has never been done, however, except when the plant was started, and before engines and generators were adjusted. The large double-pole double-throw switch enables either the motors or lights to be connected to outside reserve connection, the other being operated from the dynamo. When both sides of this switch are thrown to outside connections, the entire building is operated from a central station on a 3-wire 220 to 440 system.

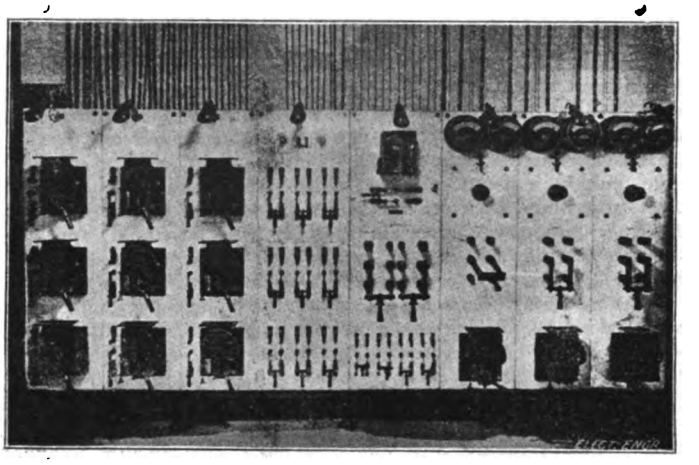


FIG. 2.

Each generator was to be connected with the switchboard by rubber-covered cable, running overhead on porcelain knobs. Each proposal was to name a price on two generators as above, with an extra price for a third unit, with one feeder panel, the latter to contain eight 150-ampere double-pole single-throw switches; eight 200-ampere single-pole circuit breakers, and one 220-volt 500-ampere recording station wattmeter—all of these being required for the electric elevator service.

SECTION D—STEAM ENGINES.

These were to be of the direct-connected type, for driving the two 75 kilowatt generators, each to be operated independently (see Fig. 1). The assumed efficiency of 80 per cent. fixed their capacity at 125 indicated horse power each. The operating steam pressure, if compound engines were selected, was to be 120 degrees above the atmosphere. Contractor was to furnish and erect these engines, ready for pipe connections, including foundations for engines and dynamos. Each proposal was to embody a guaranteed water rate per indicated horse power hour, and be accompanied by a drawing showing space occupied, foundations required, dimensions of cylinders, weight of engine fly-wheel, and sub-base, and diameter of shaft. The proposal was to state additional cost of a third unit identical with the others, for use in case electrical elevators were adopted.

The specifications were drawn for compound engines. Condensing apparatus was not deemed desirable, on account of its increased cost, complication, and space required. The fuel saving would mave been small, as the exhaust is used for heating during the five months of cold weather, when the load on the engines is also a maximum. Bidders were asked to state the price of simple engines of the same indicated horse power. The engines were to be of the horizontal centre-crank, tandem compound, high speed, non-condensing automatic type, built extra heavy throughout, speed about 250, stroke at least 14 inches,

[1]Abstract of paper read at the Nineteeth Annual Meeting of the A. S. M. E., New York, Dec., 1898.

Digitized by Google

designed for an overload of 50 per cent. for short periods; water rate not over 25 pounds per indicated horse power hour; shaft governor to be equivalent to the Rites, controlling both high and low-pressure cylinders. The drop in speed with constant steam pressure between no load and 50 per cent. overload was not to exceed 2 per cent., and was not to exceed 1½ per cent. with constant load and steam fluctuating between 100 and 125 pounds; and 3 per cent. for the combined changes in load and pressure. Engines were to operate smoothly, noiselessly, and without heating or undue wear, at all loads and pressures. Heavy cast-iron sub-bases were to be furnished of proper width to receive dynamos. Shaft to be of steel, in one piece. The usual fittings, fixtures, and lubricating apparatus to be furnished. One extra heavy fly-wheel, steam cylinders lagged, bright work highly finished. Crank pin to be of same dimensions as shaft. Engines to be finished, painted and submitted to such tests as might be required.

SECTION E—WIRING, ARC AND INCANDESCENT LAMPS, FANS AND MOTORS.

This section covers all the apparatus and material necessary to transmit the electricity from the switchboard to the points of use. The 220-volt multiple arc distribution was adopted, for reasons already explained. The arc and incandescent lamps were run from the switchboard on independent systems of wiring. Suitable cut-out cabinets, tablet boards, and switches were to be supplied. The feeders for arc lights were to be of No. 2 B. & S. gauge, on porcelain knobs in the basement, and on metal cleats in the elevator shaft. All feeder wires were to have a one-sixteenth lead cover in elevator shaft, and were to be standard and continuous, without joints, except where taps were taken off feeding tablet boards on each floor. All wiring was to be rubber covered. The distributing circuits for arc lamps were of No. 12 B. & S. wire, each two lamps being controlled separately. The incandescents were to be grouped in circuits not exceeding fifteen lamps each. Maximum drop between cut-out cabinet and lamps, ¾ per cent.; no wire smaller than No. 14 B. & S. to be used. Contractor was to furnish and attach lamps and sockets. On the upper floors the incandescent lamps were to drop from the ceiling by flexible cords with ceiling cut-outs and key sockets. The paragraph referring to insulation was as follows:

"The insulation of all wires in this building must be of best Para rubber, put on in two coats of uniform thickness without seams, the inner coat to be free of sulphur or other substances liable to corrode the copper. The copper to have an additional protection of a uniform and thick coating of tin. Thickness of insulation of the No. 14 and No. 12 wire to be 3-64 of an inch, upon No. 2 B. & S. wire 5-64 of an inch, and upon No. 000 wire 3-32 of an inch. The rubber to be covered with a substantial braid that will not readily carry fire. This wire must show an insulation resistance of at least one megohm per mile after two weeks' submersion in water at 72 degrees Fahr., and after three minutes' electrification with a current of 500 volts. The insulation of all these wires, with all cut-outs, switches, and fuses in place, must have a resistance between conductors, and between all conductors and the ground, of not less than ½ megohm per mile of circuit."

Edison key sockets were to be used throughout, with porcelain bases. Contractor was to furnish and connect six hundred 16 candle power lamps, with anchored filaments, and 600 hours' guaranteed life. The intention was to select that type of lamp which would give this life with the best guaranteed efficiency and maintenance of candle power.

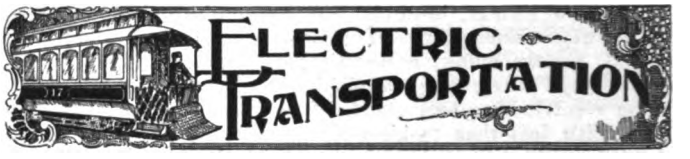
Three motors for ventilating fans were to be supplied—one in basement, one in engine room, and one in boiler room (see Fig. 1); the air to discharge into space surrounding stack. Each fan was to be 24 inches in diameter with speed variable between 200 and 600 revolutions per minute. Motors to be ½ horse power each, series wound, equipped with switches, regulating devices, iron-clad armatures, large mica insulated commutators, carbon brushes, and self-oiling bearings.

The two hundred arc lamps were to be of the enclosed type, burning 150 hours continuously without trimming. Proposals were invited on lamps to burn singly on 220-volt circuits consuming not over 2½ amperes each, and also upon lamps to operate two in series, without robbing each other, and with equal steadiness. All lamps were to have resistance enclosed in top of lamps, and be hung from ceiling on independent supporting wires. They were to have opalescent inside globes, and clear glass outside globes. To have the usual fittings and adjustments, and polished brass finish. Thirty days' supply of carbons was also to be furnished.

The enclosed arc lamp has many important advantages, among which are—that it can be run off of the ordinary incandescent, dynamo and wiring system, and that it gives a very uniform and attractive light. It does not give as much light as the ordinary open-series arc, but requires more energy, about one-third of which goes to waste in the resistance in the lamp which is necessary to control and regulate its operation. The 110-volt enclosed arc lamp, for instance, is operated with 5 amperes, but only about 80 volts are consumed in the arc itself. The 220-volt lamp uses 2½ amperes, consuming about 160 volts in the arc. Thus far, all attempts to do away with this wasteful resistance have failed, but it is believed that the inventive genius of the country will, in the near future overcome this serious difficulty.

The original schedule of lamps to be wired for was as follows:

	Arc.	Incandescent.
Basement	19	46
1st Floor	26	145
2d "	23	15
3d "	24	17
4th "	24	39
5th "	22	29
6th "	23	46
7th "	22	100
8th "	6	142
Total	189	579



The Detroit, Ypsilanti and Ann Arbor Interurban Electric Railway.

THE Detroit, Ypsilanti & Ann Arbor Railway, now operating between Detroit and Ann Arbor, Mich., connecting Detroit, Dearborn, Ypsilanti and Ann Arbor, with a number of thriving towns through one of the most prosperous sections of the State of Michigan, may well be characterized as a distinctively interurban electric road. Without extravagant and useless finish, everything pertaining to it is of the best quality, and the design of every detail throughout is such as to give the best results. The road-bed itself was very carefully prepared and the rails used are as heavy as those employed in regular steam railway practice. The overhead construction consists of double figure eight trolley wires which, with booster and direct feeders, are so arranged as to give perfect distribution and a minimum chance for line trouble.

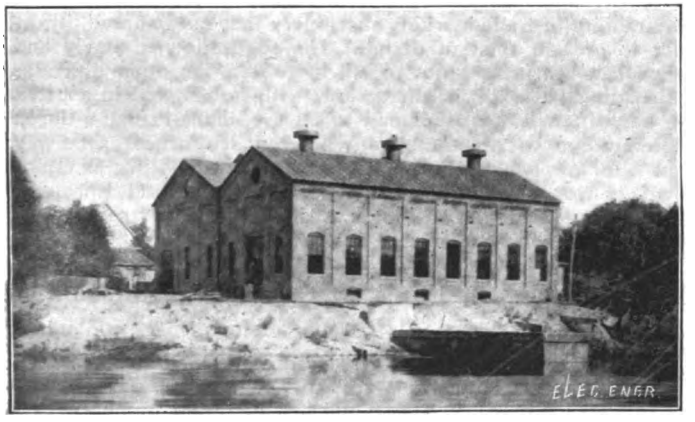
The road is a little over 40 miles in length and the regular equipment for present requirements consists of 10 very large, complete and elegant coaches for through express, local and excursion service between Detroit and Ann Arbor, with several smaller cars for local traffic at Ann Arbor. These coaches, which are over 40 feet in length, extra wide and supplied with double trolleys, Westinghouse air-brakes of special design, and all modern improvements for elegance and comfort, were built by the Barney & Smith Car Co., of Dayton, Ohio.

Each of the coaches is equipped with four 50 h. p. standard Westinghouse railway motors, of the well-known multipolar type, with iron-clad armature. The current is supplied from two power houses, one located at Ypsilanti and the other at Dearborn, practically 20 miles apart. These power houses are exactly alike except as to a few minor points due to local conditions. They are fireproof brick structures with double gables forming independent boiler and engine rooms, being plain, substantial buildings with just enough architectural effect to produce a pleasing appearance, giving the idea of practical utility.

The generating power in each station consists of two 450 h. p. Westinghouse compound automatic engines direct connected by means of flexible spring couplings to Westinghouse 225 k. w. railway generators, with foundations in place for two more units and provision for easy extension of buildings for further

Digitized by Google

increase. Independent condensers are used with connections so made that the plants can be operated condensing or non-condensing at will. Each boiler room contains three water tube boilers of nominal 250 h. p. rating each, equipped with Roney mechanical stokers, fuel economizers, mechanical draft with re-



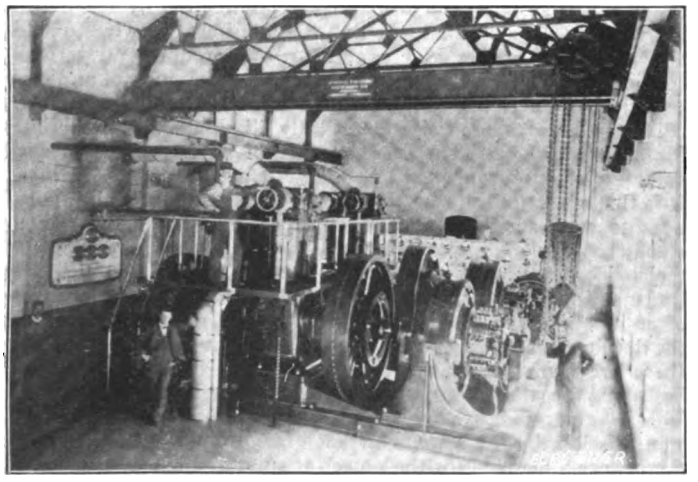
POWER HOUSE OF THE DETROIT, YPSILANTI & ANN ARBOR RAILROAD.

lay fans, duplicate feed water pumps, etc., all arranged very compactly, with particular regard to operating with a small force of men. Coal and ash handling machinery is not at present installed, but provision is made for this in connection with further increase of the plants.

The current to the distant portions of the line is conducted through feeders in which there is a very considerable drop in pressure at the time of maximum load. To compensate for this the feeders are equipped with boosters. The boosters consist of Westinghouse motors direct-connected to series-wound generators or boosters, by which the voltage to the feeder circuit is increased in proportion as the load increases, thus enabling a practically constant pressure to be delivered at the trolley line. It was found that this system of operating was very much more economical than it would be to supply the very great additional amount of copper which would be required if the boosters were not used.

The switchboards are constructed of heavy marble panels with iron framework of very neat design, and are supplied with a full complement of instruments, including meters, circuit breakers, switches, etc., for the full control of current under all conditions.

The steam piping throughout the plants is extra heavy to carry a working pressure of 175 lbs., and the arrangement is very



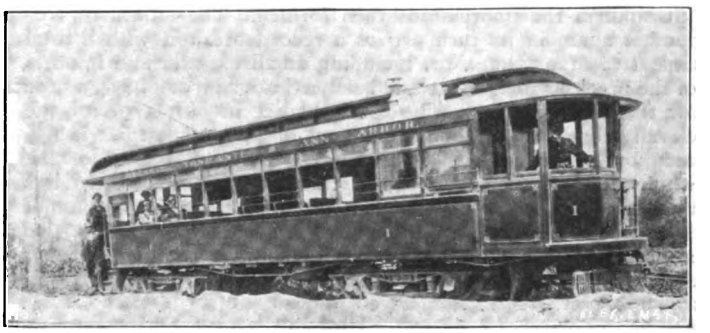
INTERIOR OF POWER HOUSE, DETROIT, YPSILANTI & ANN ARBOR R. R.

carefully designed to give flexibilty of distribution, together with stability of construction. The steam passes through large separators before going to the engines and these separators are drained by steam loops returning all water of condensation direct to the boilers, all piping being thoroughly covered throughout. Each engine room is supplied with a 15-ton traveling crane. Both plants are located upon the river bank where a full supply of water is obtained at all seasons. This water passes through cribs with screens to intake wells, and filters are used at the Dearborn plant.

The various lines of machinery making up these power stations were selected from those known to give the most practical results under the conditions obtaining. The service of such a road with a comparatively small number of heavy cars to be run at a high speed necessitates a widely fluctuating load upon the stations. The well-known constant economy of Westinghouse compound engines under a varying load insures a low steam consumption under regular operating conditions. This same control of economy under changing load is taken care of in the boiler rooms by the mechanical draft systems which enable the draft and consequent rate of combustion to be regulated most perfectly. This refinement is even made automatic by quick-acting regulators, governing the speeds of the fans according to demands for steam. By combining fuel economizers with the mechanical draft, low waste gas temperatures are secured and the heat returned to the system, netting a very nice saving in itself without excessive cost or complication. By use of Roney mechanical stokers the cheapest grades of coal can be used with minimum labor in firing.

The engineering and designing of the complete system was done by Westinghouse, Church, Kerr & Company, who also furnished all of the machinery, including car equipments, air-brakes, etc. Through the courtesy of their Chicago office we present illustrations showing the progress of the work.

This road throughout, from the business management to the



REGULAR CAR OF DETROIT, YPSILANTI & ANN ARBOR R. R., EQUIPPED WITH FOUR WESTINGHOUSE MOTORS AND AIR BRAKES.

designing and constructing, probably represents one of the most successful undertakings in the electric railway line. Westinghouse, Church, Kerr & Co. had engineers connected with the several Westinghouse interests upon the ground for several months investigating and studying the conditions from every standpoint, making comparisons as to costs of fuel, loss in transmission, etc., involved in locating the power houses and deciding upon the best type of machinery, amount of copper and other conditions to give the greatest revenue for capital invested.

At the time the Westinghouse Company took hold of the work it was in the same condition often found with similar enterprises. Valuable franchises had been secured, and many things had been worked out to show the value of the road, but nothing had been done in the line of engineering to determine how the best results might be obtained. This part of the work, as well as that of furnishing all the machinery, was turned over to the engineering concern of the Westinghouse interests upon such a basis that the system might be arranged to meet the conditions from all standpoints rather than working to a set of specifications with the idea of following them rigidly to fulfil a contract, whether they proved the best or not. Through the method thus adopted, the officers of the road were entirely relieved of details, yet at the same time were in close touch with all that was bing done, while the entire responsibility was assumed by an engineering and contracting concern equipped with a force of competent men, and backed by large manufacturing industries, to make this responsibility doubly sure.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each),	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 9, 1888.]

Vol. XXVI. NEW YORK, DECEMBER 22, 1898. No. 555.

Phenomenal Export Trade.

WE had occasion a week or two ago to call attention to some of the statistics of export trade. Later figures do but confirm the impressions then formed. The month of November again in its turn proves a record breaker, with a total export of $129,783,512, or, including small exports and imports of the precious metals, a trade balance in our favor of $74,515,662 for the single month. The total balance in our favor for the eleven months is the enormous sum of $425,464,095. It is figured by Bradstreet's that the current ratios will give for the whole year a balance on export trade of $615,000,000. In less than ten years this balance has reached the gigantic sum of $2,060,000,000, or, in English sterling, £400,000,000. It is also said that this year our exports will exceed those of any other country; and the remarkable thing is that so large and growing a proportion is in manufactured goods.

It is not necessary here to pause and inquire how these balances have been settled. The main thing is to encourage foreign consumers in the habit of buying in this market, and the two leading qualities that will confirm the habit are cheapness and excellence. In many respects this export trade in machinery and apparatus has but begun; possibly in others it has been pushed as far as it can be. We do not think that the electrical trade, for example, is by any means well developed yet, and the recent orders obtained in London and Paris are probably but forerunners. The figures of export for September and October now first obtainable in detail, are most encouraging, and our weekly figures show that the record is being maintained. During September and October of this year the exports of distinctively electrical machinery amounted to $499,731, while in the same two months of 1897 they amounted to only $246,361, or less than half as much. It must also be borne in mind that this does not include the vast range of what comes under the generic title of "electrical supplies," much of which is still grouped under the head of "scientific instruments."

At the present moment there is a very apparent revival in electrical industries throughout the country. The orders given in New York City alone would keep a very respectable factory busy for a whole year, but they are a small part of the general demand for apparatus and supplies. Our own pages bear witness to the universal renewal or expansion of old plants, the construction of new ones, and the organization of a host of new companies for lighting, street railways, power transmission, telephony and miscellaneous electrical purposes not contemplated until recently. Enterprise has been repressed so long that it is fair to assume most of these schemes represent real public wants, the satisfying of which will be profitable to the companies interested. It is certain that the work thus outlined implies an enormous demand for equipment, quite independent of the export trade, but related to it in the sense that the larger the production the lower prices can be made all around. It is this liberal patronage of electricity at home that has been laying the foundations for an unrivaled export.

Before leaving this subject we would like to draw attention to the admirable note from the well known patent and trade-mark authority, Mr. Francis Forbes, in regard to the propriety and desirability of trade-marking machinery that goes abroad, in order to prevent theft of design. The suggestion is timely and pertinent, but it does not touch, of course, the other difficulty of sending out explicit instructions with goods sold in a batch to be scattered afterwards and to be used later in half-a-dozen different countries, with as many different languages. One way out is for mechanical Europe to use English only, just as diplomatic Europe has used French. There are several European languages that ought no longer to be permitted or recognized, except as intellectual luxuries or provincial oddities.

Prof. Forbes on Long Distance Transmission of Power.

AFTER one has read the masterly paper by Mr. Chas. F. Scott on "High Voltage Power Transmission," an extended abstract of which we published in recent numbers, presenting data based on actual experiments conducted by the Westinghouse Company, one is naturally interested in the calculations and speculations of Prof. George Forbes, contained in a paper on "Long Distance Transmission of Power," delivered before the Society of Arts, London. The author, who is well known to American engineers, bases most of his conclusions on curves prepared by himself, and the value of which on account of "the time not having arrived yet for their publication," has only been evident to the Professor who "never travels a day without this (a current density) table in his pocket." Their early publication, if they are based on such valuable work as Prof. Forbes implies, would be invaluable to his professional brethren who unite with him in considering the question of high voltage and long distance power transmission as a timely, important and uncertain one. The titles of the two papers above referred to give the reader a general idea of the method of treatment of the subject pursued by each author and enable one to make interesting comparisons and indulge in fruitless speculation as to the limits of voltage and distance. Mr. Scott reaches the conclusion after a thorough sifting of all data on hand and equipped with a vast amount of experience that "voltages of from 15,000 to 20,000 volts have been and can be used, and also that no new or modified methods of transmission will be required before 50,000 to 60,000 volts can be employed for distances up to 150 or 200 miles." Prof. Forbes is content to employ voltages—in his calculations—not exceeding 20,000 or 30,000 volts, but talks unhesitatingly of 400 and 500-mile distances. He thus avoids or passes over in silence the critical point in a transmission system—the insulator—as pointed out by Mr. Scott. but we need not entertain fear that the loss between wires would be excessive. Cables and conduits would require no serious consideration, and apparatus for the generation, control and distribution of such voltages can now be bought on the market. All these factors then being practically eliminated, or negligible for a time, the problem becomes one of strictly financial and commercial importance, and as such is treated by Prof. Forbes. It is this aspect of the case that has probably confined high voltages to such small distances in the past and has made capital somewhat reluctant in coming to their rescue and furthering their wider application. In the words of Dr. Louis Bell, "Power transmission is of little avail if it does not pay, and the chances of commercial success form the first subject of investigation in the development of any power transmission enterprise." Whether these are favorable or not, he says, cannot be stated a priori. but must be thoroughly investigated in each particular case. This is answered by Prof. Forbes, in speaking of very long transmission, by the statement that "In all cases it would pay if there were a demand for the power at suitably high rates." This brings him to the question of the supply of electric current to gold mines situated at a distance from water power, and he claims to have shown that the power of the Victoria Falls on the Zambesi, might be economically transmitted 500 miles for the development of mining in Rhodesia, if these mines show as good returns at the Geelong and Selukive mines have done. This is certainly a bold and extraordinary statement, and when

Digitized by Google

the "show" is actually opened, hearty applause will greet the Professor. He next addresses himself to financial men, especially those of London, who he says have a wonderful instinct by which they know the important points to be certain about before supporting a scheme with their money. Kind words, such as these, certainly ought to bear fruit.

The fears of capital, put in the form of questions by Prof. Forbes, are the following: 1.—"Has electric power ever been carried to such distances as you speak of?" The answer he gives is "No. But electrical practice is advancing by strides." 2.—"Are you sure that no new electrical difficulties will arise when you go beyond the 108 miles of transmission, which has been accomplished?" and his answer is, "We are sure of this from the tests made at Frankfort." 3.—"Are not the losses by leakage on a long line insurmountable?" and he answers, "There is hardly any loss by leakage. There is loss of power used up only in warming the transmission lines." The Professor is of the opinion, however, that we would gladly waste that power if it saves copper, which is the great cost. 4.—"Well, but if you allow a great loss of current in transmission, do you not require an enormous quantity of copper to carry the extra current which you have to generate?" to which the Professor's reply was that "Up to a loss of 50 per cent. on the transmission line you are always saving copper by having greater losses on the way," assuring us, however, that the whole question is one or £ s. d.

Prof. Forbes remarks that in some cases miners were prepared to pay from $500 to $1,000 per annum for each horse power, and that the electric lighting of Cairo could be done cheaper by power generated 400 miles away, at the First Cataract, than by steam engines in that city; and he expressed the conviction that the cataracts would soon be harnessed. In this scheme the copper would cost $1,440,000 and the machinery $160,000, and as the copper is not in any way deteriorating, he has proposed to the copper merchants that they should raise the copper mortgage at say 4 per cent. to cover the chances of a change in market value should the copper be taken up by the foreclosing of the mortgage. "This scheme," he says, "I have laid before the manager of one of the largest copper companies, and he entirely approved of the general idea." The remainder of the paper is addressed to engineers, and is a thorough discourse on Prof. Forbes' numerous curves which he has found of such great value. That portion of the paper teems with interesting figures and opinions, such as the Professor's habit in his preliminary work on the cost of long conductor lines of dealing only with current density and loss of volts, not resistance and current; never the efficiency of a system but always its reciprocal, which is the horse power put into the generating end of the line to deliver one horse power at the other end. The Professor further gives some interesting formulæ and tables and shows how to apply them, all of which are of great value if they can be applied without serious error to any particular problem requiring solution. Prof. Forbes may not be popular, and his manner may be offensive in his mingling of dogmatism and self-complacency, but he sets his professional brethren thinking, and is ever in the vanguard of progress.

High Fireproof Buildings.

THE recent fire on Broadway, New York, when a couple of very tall buildings were attacked from an outside source, and one of them was badly damaged by the flames above the eighth or tenth story, has begot some clamor against the modern skyscraper, and proposals are afoot to limit their height on the score of great fire risk. Some good people want to see the limit set somewhere around ten stories, chiefly because that is as far as existing fire apparatus can play a stream of water on them.

Having been occupants ourselves above the tenth floor for several years, in more than one of these skyscrapers, we desire to file our protest against such a retrograde movement. These buildings have furnished a fine market for electrical apparatus, and hence for that reason alone we should be sorry to see their growing numbers checked. Fast electric elevators, fine lighting plants, facilities of all kinds are enjoyed, which have become the necessities of business life, and do much for comfort and the expedition of affairs. In summer such buildings are airy and cool, and in winter they are light and bright. As to the danger from fire, it is grossly exaggerated, the real danger being from the outside. We have stayed in one building with our whole office force, including three or four ladies, while one of the lower floors, full of the files of a daily newspaper, was in roaring blaze and while the street below was alive with fire engines; but the office work went on, and not a woman stopped or left her post. Nothing in the recent fire shakes the confidence then exhibited.

This week we publish a rattling article from Mr. Jean Wetmore on this subject, in which he shows how electrical apparatus could be brought into play in fire suppression. In the main Mr. Wetmore's brisk analysis of the situation meets our hearty approval. We do not take quite so much stock as he does in the superior progressiveness of the West or in the superior skill of Western fire fighters. When the West is as solidly developed as New York is there will be a corresponding inability to change front every five minutes; and we have an idea that the firemen of New York stand well in the estimation of their fellows everywhere. But there is decided room for improvement, and Western alert example teaches that all the possible changes for the better in city life have not yet been effected by any means.

Naming a Specialty.

IT cannot be the easiest thing in the world to name a new specialty, and one does not wonder at the fact that the manufacturers sometimes invite the public to help them, shrewdly offering prizes as a stimulus to the imaginative talent invoked. A case of this kind has just occurred in the electrical field, and the results are rather interesting. The specialty was an improved incandescent lamp, liberal prizes were offered for a good name, and the company made its needs known with judicious energy, so that if anybody had a taking name to propose, the competition was likely to elicit it.

Our readers have been made familiar with the decision of the judges, and we must say that the award seems to be a very good one, and hard to beat for comprehensive regard for the situation. But the company has been kind enough and quick-witted enough to print a list of all the names proposed, and the list is little short of extraordinary. It is hard to believe that some names were proposed with any serious intention of winning the prizes; and yet the earnest effort made in "naming the baby" is frequently apparent. We admire the nerve of the man who proposed "Izzers," because "we don't want has beens, we want izzers," while the other man must have been even more serious who said "Owl," on the plea that "the lamp helps you to see after night or does its work after dark." As might have been expected, there are nearly two score with "Dewey," but we are disappointed at finding no "Hobsons," or "Miles," or "Teddy," and only one "Schley" and one "Sampson." The judges did well, however, to pass over "Dewey" and not less well to reject "Santiago Search Light," urged "because of the vigilance kept on that city during the siege;" and "El Luna," recommended "because the war is over and we can again speak Spanish up here." Perhaps "White Hot Hairpin" was suggested in irony, but it must have been an Englishman who sent in "Delight," because "it is de light of the day." Slang finds expression in the names "Korker" and "Cinch," but these are offset by mythological and philological efforts of sundry kinds, such as "Venus," "Alcione," "Jupiter," "Metosis," "Savrogan," "Clair Mide," "Carbose," "Classic," "Efphilgence," and "Plenipotent," or "Longival." We cannot say that we are struck by "Moon Sun," but there is a novelty about "Sun Blink" that might have won a prize.

Exterior Incandescent Lighting.

THE Grand Court at the Omaha Exposition demonstrated in a beautiful and astonishing manner the usefulness of the ordinary incandescent lamp for exterior lighting, and must have been suggestive to many central station managers who saw it. That exterior and street lighting must be done generally with arcs is, we believe, an admitted fact, but there are experts who, like Mr. Edison, believe that the incandescent has not yet been tested for such work up to the full measure of its ability. It will be remembered that at Columbus, O., regular arches were set up by the merchants along certain streets, with good effect on trade; and we received inquiries on the subject from various parts of the country, showing a lively interest in the matter. We are now able to show how the Chicago Edison Co. has lately evolved a very ingenious and effective plan for incandescent street lighting on a wholesale, free-handed basis. While it may not be of a permanent character, it has many and various recommendations, and seems to us to open up opportunities for city decoration that local companies will be glad to seize.

Digitized by Google

MISCELLANEOUS

Radical Changes Necessary in Fire Extinction in New York City.

BY JEAN WETMORE, E. E.

A FIRE lately occurred on Broadway involving an old style low building and a modern fireproof skyscraper. The Fire Department sent rattling along its antiquated paraphernalia, but on account of a high wind it was unable to control the fire in the low building, and because some inspectors were delinquent in their duties in not having the skyscraper provided with fireproof window shutters, the latter caught and burned out the interior of its upper stories. The fire chief did the best he could with his Lilliputian apparatus, his little steam squirt guns on wheels puffed and snorted, his Siamesed pipe-stem of a perambulating water tower could not be lengthened 17 stories high, and so he called more funny little squirters and towers to his aid. But all the chief's horses and all the chief's men could not effectively squirt higher than nine stories. The chief saw the ridiculousness of his puny efforts, for he is quoted as saying: "Let her burn, boys." An extended conflagration might have ensued as far as the department was concerned had not the high fireproof structure stod like a mighty bulwark and fire wall to protect what was beyond.

Old method "authorities" now tell us a law should be passed prohibiting buildings being built over a certain limited height in New York, all because the Fire Department's apparatus has not kept step with the changed modern building construction; a little later some more "authorities" from sleepy Philadelphia, where the grass is supposed to grow in the streets, came to view the ruins, and they also evoked a new law limiting building heights and imply as well that modern progress must be jerked back to the limits of their old claptrap fire-fighting apparatus. They do not even concede that fire extinguishing methods can be made to conform to the changed building construction. The whole thing is a farce worthy of being treated by a Cervantes or a Dean Swift.

It took Chicago to build a World's Fair that surpassed the best European effort. Our city's best effort in this line has been the old Institute Fair, food exhibits at the Grand Central Palace, Madison Square Garden horse show and Barnum's circus. San Francisco and Kansas City had cable street railways about the same time that our Broadway had a horse car line, and even this line was fought hard by the merchants along the route, who frothed at the mouth and frantically gesticulated their wrath and crucified poor Jake Sharp for employing the only means, bribery, to give the city this great benefit. It is hard for a man to be progressive and honest and suceeed in this city.

Chicago has used electric traction on her elevated roads several years, and we are still enduring the discomforts of sulphurous fumes, cinders, ashes and dripping hot water. We were copying the Prince of Wales' clothes and London stage coach locomotion long after Western cities had electric traction. Chicago, Milwaukee, and little Akron, Ohio, had their electric wires underground long before we conceived the practicability here. The same with the improved fire and police telegraph methods, and it is the same with nearly everything else.

We are the true mossbacks, and have much to learn in fire fighting methods from the energetic, wide-awake, wild and woolly West.

Even the subtle, strong, convenient, economic, safe, fireproof, modern, steel-frame skyscraper we copied from Chicago; our architects and capitalists were pessimistic on the subject long after its worth was proved in the West.

All experienced traveling men know that a fast express train is safer than traveling on an accommodation or a freight train, and for much the same reasons a skyscraper is safer on account of the great skill and the best of material used in construction. Who ever heard of the necessity of shoring up one of these buildings to keep it from tumbling down, like the low, flat Rothschild Building in Brooklyn? Instead of laws limiting the height of a building, called for by the New York and Philadelphia fire chiefs, we should require laws compelling the building of nothing but skyscrapers along the blocks facing Broadway in the place of the low buildings that are the true sources of conflagration. Who ever heard of a serious fire originating in a skyscraper?

Two parallel blocks of rows of skyscrapers from the Battery to the Harlem River would prove an efficient fire wall, extending along the backbone of Manhattan Island to prevent an extended conflagration in a high wind, such as devastated Chicago before they were built in that city.

The more twenty-five and forty story buildings the better. Blow up the old rathole firetraps that disgrace our main thoroughfare and allow us to become a representative modern city.

If our burnished toys of perambulating steam squirt guns with their water towers cannot squirt higher than nine stories, they are evidently of little use under changed modern conditions. Relegate them to goat town, or keep them for holiday parades when the old volunteers drag their little hand pumps along in memory of ancient times.

The next step will be as drastic as it is important; sweep out the whole official personnel of the present Fire Department, Commissioners included, for it is not worth the pains to teach old dogs new tricks, and it is as impossible to reform confirmed old mossbacks as it is to rejuvenate old maids. Then send West for energetic, up-to-date, resourceful young men, who have ozone in their blood, the same breed that made the World's Fair a success, and empty-handed built up her commerce and her industrial successes, and who are all devotees of the Western goddess, "I Will," to replace the old "Has Beens," who want the world to stand still because they can no longer keep up with modern progress.

Then get some more of the same ilk from the same place, for we cannot find them here, who will inspect buildings during their construction, and not after they have fallen down or burned up, for we have had too many Budensieck and Rothschild structures.

The next problem to be solved is to make each skyscraper its own stationary water tower for its individual purposes, and also to drown out fires in surrounding buildings, even those across the street, and to water soak any insignificant tinder box structure that may be on fire below.

Then construct permanent stationary means to conduct plenty of water to each building, independent of the present ove taxed water system, and then to provide means to get the water to the place needed with sufficient force.

To Western people the solution of these problems would be simple, easy and quick of practical execution. But to the old fogy mossbacks and time servers in charge of our Eastern municipal departments, I doubt the possibility of the change unless we place the ideas on their heads and drive them clear through their cobwebby intellects with an axe; for their only originality consists in pulling down the buildings that are the pride of our city, in order to bring their roofs within the reach of their grovelling intellects and their little puffy old steam squirt guns.

The tall buildings of Western cities are provided with two or more stand pipes reaching through to their roofs, to which two or more engines may be attached to each pipe when necessary, and the water pumped in solid, unbroken streams, unaffected by prevailing winds to any desired heights; and in certain sections of these cities hose carts do not accompany an engine.

Other cities, like Detroit, have laid underground conduits from the river independent of the usual water supply system, and a powerful fire boat forces the water to the desired locality, and may be operated if desired in conjunction with the stationary stand pipe, with or without the assistance of the usual fire engine.

Few of our buildings are provided with accessible stand pipes, and we are unable to avail ourselves of the admirable river fire boats for inland purposes; our only auxiliary to the toy fire engines is a water tank on the roof that seldom, if ever, is full, or holds enough water or gives adequate pressure where and when most needed; or a pumping apparatus in the basement that is of little use on account of the time to get it in operation, or is of sufficient capacity. Both of these aids practice has shown are quite impracticable and unreliable.

There is probably no city in the world so admirably situated as New York for adequate fire service to meet modern requirements. For, situated on a long, narrow island, completely surrounded by water, and salt water at that, we have ideal conditions for an ideal installation. We may even banish hose carts,

Digitized by Google

water towers and engines on wheels, and stop killing our citizens and the firemen (who are often strapped to their seats), in their mad career through the streets, sell our engine houses and take our firemen to fires in comfortable patrol wagons unaccompanied by the deadly juggernauts of dangerous fire apparatus.

This may be done by building underground parallel pipe lines at convenient distances apart from both the East and North rivers, toward Broadway, with suitably situated and accessible valves to prevent undesired intercommunication.

These pipe lines could be connected to commodious stand pipes in each building, and each floor provided with hose, and each fourth floor provided with pipes branching toward the exposed sides of each building from the stand pipe, and provided with a dirigible nozzle toward the street and areaways.

The river ends of each pipe would be provided with three to five Siamese connections, to which the same number of fireboats could be connected. It will then be possible to generate a water pressure that will blow the very skylights out of a fifty story building, and if five fireboats cannot do it, connect the stand pipe with five other fireboats from the other river.

A fire on any floor of a building thus protected may be fought from within by half a dozen streams of salt water, and from without with as many more from adjoining buildings, especially from across the street, and if any tiny steam fire engine wheezes its protests, it could, by these means, be washed into the bay.

If it be economical to build skyscrapers it will pay to protect them.

This system may find other very economical uses, such as flushing the sewers, sprinkling and sweeping the streets, melting snow and quelling riots.

The construction of a complete system of fire protection for Manhattan Island, substantially of the character described, would give it facilities far ahead of anything in the world. Then why wait for Oshkosh or Kalamazoo to set examples for us to follow like imitative monkeys, or adopt some little wrinkle from a jay town out West, when nature has given us advantages enabling us to be leaders and grandly systematic and progressive? As a city we should be admired and imitated for our progressiveness, instead of ridiculed for our conservative, servile imitations and antiquated, ineffective fire system.

The upper part of the island being much wider than the lower part, and the centre being further from the river on each side, we might require an auxiliary system in case sixty-story buildings should be built in Harlem. When that time arrives we will be duly prepared to master the situation by installing at convenient distances throughout the buildings compact, efficient, direct-connected electric rotary pumps, taking their power from those unfailing sources of supply, the electric light and electric railway circuits, or both conjointly, to insure positive results. This auxiliary system would help out our parallel pipe system as outlined above, and compensate for the water friction in the additional length of pipe lines, and the added heights of the stand pipes, and in case of accidents of any nature, these electric pumps could be connected with the present water system.

Our present fire system is from recent examples too glaringly inadequate and out-of-date, and even though my suggestions are adopted finally by the city, it will take municipal fathers and heads of departments so long to get their "political matters" agreeably adjusted, that I would seriously advise the owners of our skyscrapers to place no further reliance on the Fire Department, or await the tardy action of the Commissioners in the matter, but take immediate steps to install the electric pump system as outlined for emergency purposes, and thus be independent of municipal incapacity and procrastination. The chief points in its favor is the quickness, facility and cheapness of the installation and operation. It requires no skilled attendance, other than the intelligence of turning a switch lever or a rheostat handle, and requires no addition to the present building employés. No steam boilers or additional machinery will be required. In fact the system will be independent in all respects from existing apparatus, with practically no expense after installation, except interest on cost price and for electric current in case of fire, and possibly no appreciable extra piping, as the pumps could be connected directly to the existing water supply pipes.

This will be the most efficient makeshift possible until a dozen more million dollar fires thoroughly accentuate the utter worthlessness of our fire system, and a long-suffering public get thoroughly aroused and demand radical improvements.

Electrical and Engineering Work in the Navy During the War.[1]

BY W. D. WEAVER, LATE CHIEF ENGINEER OF U. S. S. "GLACIER."

THE lessons taught by the late war with respect to the employment of electricity aboard men-of war are few in number, though important in their bearing. The most decisive result was the demonstration of the immense superiority of electricity over steam for the operation of turret training apparatus —a demonstration so decisive, in fact, that the question of the employment of electric power for this purpose is no longer an open one. The Society is to be congratulated that one of its members is the inventor of the system whose application has led to this happy result. I refer to Mr. H. Ward Leonard.

Another question which the test of battle has settled definitely is the superiority of electric ammunition hoists, not only in efficiency in working, but in its convenience with respect to location and space occupied that will tend to greatly extend the application of electric power on shipboard generally.

Against the great success in the particulars just mentioned must be set the failure of electrical range-finding apparatus, and of electrical indicating apparatus in general. As to the first mentioned, the enemy gave so few opportunities for its use, and even then so little necessity existed for its employment in view of the leisurely manner in which our vessels could pick up their range, that possibly neglect had something to do in the case.

At any rate, electrical range-finding should not be condemned in general because of the failure of a single system. In fact the weak points in the one in question would seem to be easily overcome by the employment of alternating currents of high frequency and considerable voltage, thereby enabling a drop between indicating points to be obtained by means of inductance which would be in the order of volts instead of possibly millivolts, as where the direct current is used. I will add that an apparatus somewhat answering this description has been proposed by Messrs. Crehore and Squier.

As to other indicating apparatus, it should be borne in mind that electrical apparatus of this nature requires a certain amount of expert care which it is not always possible to obtain aboard ship, while the contrary is the case with the mechanical apparatus that it would displace. If in anticipation of battle the latter is thoroughly overhauled, as would be the case, there is more assurance of its efficient working than electrical apparatus under the adverse condition named, notwithstanding the inherent superiority of the latter. This brings up the question of the deficiency aboard ship of necessary electrical skill, which has been made the subject of an official report by the Bureau Officer in charge of electrical engineering, and will be referred to later on.

The favorable experience with electric power in the important cases just mentioned should accelerate the extension of its application aboard ship, and while, unfortunately, the present bureaucratic tendency is not in that direction, as will be noted later, I shall nevertheless, refer to some other cases distinctly calling for such application.

The one of immediate importance, and which in fact can be considered a crying necessity, is that of electric ventilation. For warship ventilation, both with respect to coal economy and deriving the most efficient results in ventilation itself, the electric fan offers an ideal solution. The modern warship being divided into numerous compartments, each of these can be supplied with its own electric fan or fans, either for isolated ventilation or to supply a system of only such extent as will involve no sacrifice in efficient ventilation. The type of engine now employed with steam ventilators undoubtedly requires anywhere from 75 to 200 pounds, and even more, water per horse power hour. In the case of a large electric plant and with fan motors of the most ordinary efficiency, this would be reduced to considerably below 50 pounds, while at the same time the ventilation for a given expenditure of power would be greatly increased in efficiency.

Whether electricity should also be applied to furnace blowers for forced draught, is an open question at the present moment, in view of the very infrequent use of such blowers and consequent large idle electric plant normally that would be entailed.

Other employments of electric power, so obvious that their adoption cannot be greatly delayed, are in driving the workshop

[1]Read before the New York Electrical Society, Dec. 14, 1898.

Digitized by Google

and ice machine now installed aboard every warship. The engines of the latter are particularly inefficient, aside from their immense inconvenience through the heat given forth. In these cases the application of the electric motor is so simple that it cannot be open to question, and the same remark applies to winches and ash hoists. On the ship of which I was chief engineer there were six of these, which, I estimated, consumed steam at the rate of over 150 pounds per horse power hour, not counting the great condensation in the long lengths of steam-supply pipes.

Steam pumps are, as is well known, grossly inefficient in steam consumption, and the same is true to a lesser extent of other auxiliary machinery connected with the propelling engines. While it may be claimed that it would be inadvisable to render the operation of the propelling machinery, particularly in time of battle or during storms, dependent on obtaining power from the electric mains, in reply it may be said that the number of different engines at present employed to run the auxiliary machinery is in itself a great hazard, for the breaking down of almost and one alone would effect the operation of the main propelling machinery.

Among other probable applications of electricity in the future are to anchor hoists and steering gear. The navy has had a somewhat unfortunate experience with the latter, and this, by the way, carries a lesson with it for those interested in introducing new electrical machinery aboard warships. The lesson is, that in every case possible, such machinery should first be tried aboard merchantmen, and all experimental work entirely completed before attempting to secure adoption by the navy. In many cases it would possibly not be a difficult matter to find opportunities for making the trial on coastwise or freight steamers, or on harbor vessels, though sometimes, however, at the expense of those putting the apparatus aboard. Steering gear and anchor hoists now furnish good subjects for the electrical designer, and if previously tested in the manner described, would undoubtedly stand an excellent chance of adoption for use in the navy in the near future.

As I have intimated, it must be reluctantly acknowledged that, notwithstanding the extremely efficient showing which electricity made during the late war, it is apparently at the present moment not in high favor at the Navy Department. The Chief of the Bureau having charge of electrical matters has recently reported very gloomily concerning the difficulty experienced aboard ship in keeping the generating plant in an efficient state; and the Naval Board of Construction has recently refused to further extend the application of electricity on shipboard, the decision being that the use of electricity has gone far enough for the present.

It is quite probable that this unfortunate decision was arrived at owing to the unfavorable condition referred to concerning efficient operation. Why the operation of an electric plant of the size installed aboard ship should present any considerable difficulty will probably be a puzzle to those here present who are conversant with electrical operation ashore, as it would also to those familiar with merchant ship electric lighting. The clew is given, however, in a remark by the Bureau Chief as to the difficulty met with in obtaining an efficient operating force, the fault thus lying, it is to be surmised, not with the electrical apparatus, but with the electrical personnel.

In view of the manner in which professional pride and the electrical industry are thus affected, it would appear entirely appropriate for the electrical fraternity to use its influence to have the appropriate remedy applied to the serious defect which has thus been officially acknowledged to exist. What this remedy should be, might well prove the subject of a Departmental, or even of a Congressional, investigation. That it is due to a faulty system, and not chargeable to lack of zeal on the part of the officers affected, can, I believe, be taken for granted.

Transportation of Exhibits to Paris.

M. Picard, Director General of the Paris Exposition of 1900, has arranged a transportation or freight tariff with the six large railroads that do nearly all the carrying in France for the transportation of exhibits from the seaboard to Paris. All goods or articles to be exhibited at the Universal Exposition in 1900 will be carried to Paris on these railroads at a reduction of 25 per cent. from the regular rates and returned from Paris to seaport towns at 75 per cent. less than current rates. The United States National Association of Manufacturers, of which Mr. C. A. Moore, of 111 Liberty street, this city, is vice-president, is looking after the interests of its members on all matters pertaining to their exhibits, such as transportation, installation, and care of displays.

Trade-Marks on Electrical Apparatus.

BY FRANCIS FORBES.

PERMIT a constant reader of The Engineer to add a word to your editorial of Dec. 15, "How to Develop Export Trade." Evidently your space did not permit you to call attention to the necessity of trade-marks on all machinery, and especially that which is to go abroad. You say that "One sale was reported not long ago of several hundred equipments, in a lump, to be scattered all over Europe, as subsequent orders might determine. How could a manufacturer label that batch?" He could first have labeled each article of the batch with a trade-mark; and ought to have done so in order to prevent the deception which the use of English words on copies of the equipments made abroad might cause.

But the manufacturer must go further than label his machines with a mark, which is a valid trade-mark here. He must label them with a mark which will be a trade-mark in the country to which exported, otherwise the foreign coypist will probably copy the mark, as well as the machine, and may even make the mark his own trade-mark to the exclusion of the original American manufacturer.

The only country of any prominence where the registration of a trade-mark is unnecessary to its validity is the United States. In most countries registration is that which gives validity to the mark. In such countries the first person to register the mark owns it, with the result that if the American manufacturer sends to such country, his agent there can register the mark in his (the agent's) own name, and, subsequently, exclude all machinery bearing the same mark unless imported through his agency. This applies to his principal as well as all others. By proper registration of the mark so much of the export can be protected from imitation, and the American goods can be found by those who want the genuine.

Goods are bought more and more on their trade-mark, because of the very fact of imitation of all else. It is the duty of the manufacturer, therefore, to use marks and to make them valid trade-marks by registration or other process of law, wherever the goods may go.

There is an international registration of trade-marks little known in this country which Congress has not yet made available to our citizens by proper laws. The expense is about $2.50 per country.

LETTERS TO THE EDITOR

City Electric Lighting at Crawfordsville, Ind.

A CLIPPING was forwarded to our city clerk, purporting to have been taken from your journal of the 17th inst., quoting Crawfordsville as saying: "We do own our light, but if we did not, we would not, for in my opinion it will bankrupt the city." If this was uttered by any citizen of Crawfordsville, he either did not know what he was talking about, or is, as some are, an enemy to the electric light system and the city's welfare.

We have the best lighted city in the State of Indiana. Our city comprises four square miles, and is lighted, equally all over, by 145 arc lights of 2,000 c. p. each. These lights cost the city $47 each per year. Now, then, this cost includes 4 per cent. for depreciation and interest on the investment. We know how, and also propose to put our plant in such a condition, that it will not only furnish the street lighting free of expense to the city, but will net us a tidy little sum of money each month as a clear cash profit.

Two old style National alternators, of 1,000 lights capacity each, are now furnishing this immense amount of arc lighting at this extremely low cost. If this is not a good showing, and does not look like anything else, besides bankruptcy, then I

Digitized by Google

am not able to figure the sum of 2 + 2. I failed to explain also that we are furnishing the Y. M. C. A. with ninety-five 16 c. p. lights free, and all the city buildings with all the light used, all included in the above cost.

F. D. ABRAHAM, Supt.

TELEPHONY AND TELEGRAPHY

The Collection of the Telegram Stamp Tax.

THERE continues to be considerable discussion over the telegram stamp tax and as to means of transferring from the public the burden of its incidence. A special dispatch from Washington of December 14, says:

The question, who is to pay the one-cent tax, seems therefore to be sufficiently answered in the text of the statute. But this would not trouble the public very much in any event. The complaint of the patrons of the telegraph—now including nearly every one who maintains any correspondence at all—has to do, not with the burden of the tax, but with its annoyance. The difference between paying a quarter of a dollar and twenty-six cents for the transmission of ten words by wire does not cut any appreciable figure; but the unconscionable nuisance of having always to hunt up a stamp so as to assure one's self against a $100 penalty is enough to spoil the temper of the most patient. Especially trying is it when one receives a dispatch of inquiry, with a request for an immediate answer. By any rule of logic, the person who requests the answer and is prepared to pay for its transmission should also pay for the stamp which must be attached to that answer. But no, the telegraph company demands its stamp, or its cost, before the answer can be put upon the wire, and under the plain terms of the act it seems to be justified in so doing. For its own protection, and to stimulate its employés to vigilance in its interest, it charges against the wages of the messenger or clerk who accepts an unstamped message the cost of the stamp. Thus hedged about, the customer's chances of escape from the nuisance are reduced to a minimum.

There is undoubtedly a wholesome moral influence in a system of taxation so distributed that the greatest possible number of citizens share the load, and of such a character that every citizen shall be conscious of the tax when he pays it; and in these particulars a telegraph tax is ideal. But a tax which, however light in itself, causes needless irritation in its collection, must, to a greater or less degree, defeat its own ends, and here the stamp nuisance is doing all that is possible to impair the success of the telegraph tax. If it were possible to procure the figures necessary for comparison, they would probably show that the telegraph business has not enjoyed its normal proportion of increase during the last six months, and all because of the compulsory advance payment of a one-cent tax.

Just how Congress could change the law without inflicting injustice where it now inflicts annoyance, is an open question. Perhaps the most practicable suggestion is that the patron of the telegraph shall be charged, as now, one cent more on each message than he was charged before the enactment of the revenue law, but that the product of the tax shall be turned over to the Government in bulk by the telegraph company, thus saving the patron the petty annoyance to which he is now subject. The telegraph managers would doubtless protest vigorously against this change, as it would involve a deal of extra bookkeeping. As it is now, the several agencies make a very simple form of returns to the central office, counting each message transmitted or delivered as one, regardless of its source or address. An agency which transmits 100 messages in a day would therefore, if the company paid the tax, have to make good $1 in taxes, though a part of the dispatches might be Government business or communications between foreign diplomatists, or belong to other exempt classes of matter.

A change in the system of bookkeeping and returns would not be an insurmountable obstacle, however, if that were the only thing which stood in the way of a reform of the present system. What telegraph companies undoubtedly fear is that, if Congress once addresses itself to the amendment of the law at all, it may amend it so as to take the whole burden off the public and cast it upon them. This fear is not unreasonable, and the consequences of such a transfer of obligations now might be much more serious for the corporations than the imposition of a tax upon the corporations alone would have been if undertaken in the first place. Congress goes at these things with a meat axe where a body of well-trained economists would use a scalpel. When it first thought of taxing telegraph messages, it had in view the collection of a tax from the companies upon the amount of business done, and not from the individual patrons. Then the opinions of the law-makers hovered between one-quarter and one-half of one per cent. upon the income derived from messages. If, however, the present tax were to be shifted bodily from customers to companies, it would mean a tax of about three per cent.—a tremendous load; for the actuaries' figures show that the average income of a large company per message is between 30 and 35 cents, and the tax is one cent.

To show that the apprehension of the telegraph companies as to the danger of ill-digested legislation is not unfounded, it may be recalled that as Section 7 of the present war revenue act was drawn, and all ready to go through Congress, no exemption was made in favor of Government messages. Had the section remained in that shape, every Government officer or employé who sent a dispatch on official business would have been confronted with this dilemma: if he failed to stamp the messages he would be personally liable to a fine of $100 each; and if he did stamp them he must pay for the stamps out of his own purse, as there was no appropriation which could be twisted to fit such an expenditure. Fortunately, some one drew the attention of the law-makers to this absurdity, and it was corrected in time; but the fact that it came so near to enactment shows with how much nicety Congress studies its work.

The telegraph tax which was imposed by the act of October 1, 1862, was dropped when the act was revised, 21 months later. The supposition is that its repeal was due to disappointment at the small revenue derived from it. But in those days the wires had not begun to be used for ordinary correspondence with the same freedom as now. Moreover, with the somewhat elaborate classification of stamps of the Civil War era, it was always possible to ascertain how much revenue had been obtained from this source and how much from that; whereas now, with one style of stamps covering everything, from a one-cent telegram to a check for a million dollars, no such accurate estimate can be made. There is no likelihood, therefore, that Congress will drop the present telegraph tax because of dissatisfaction with its fruits. The most that is likely to be done with it is to change its form in some particulars so as to make it less offensive.

Some Figures From the Cuba Submarine Telegraph Co.

AT the fifty-fourth ordinary half-yearly general meeting of the Cuba Submarine Telegraph Company, Limited, under the presidency of Mr. Charles Parish, a dividend at the rate of 6 per cent. per annum and a bonus of 50 cents per share, both free of income tax, were recommended, leaving $18,000 to be carried forward. The chairman, in recommending the adoption of the report and accounts for the half-year ended June 30 last, said the board was glad to be able to present such a satisfactory report, notwithstanding the anxious period through which they had passed since the last meeting. On the outbreak of hostilities the American Government practically took control of the cables of the Western Union Company at Key West, and instituted a strict censorship over all messages. The Spanish authorities at Havana were consequently compelled to send their telegrams via Santiago to Spain. That also applied to public messages. The diversion of traffic caused a considerable increase in the receipts of the company. In fact, many messages from Havana were carried over the whole length of the system which would not under ordinary circumstances have touched their lines at all. Many of the company's cables were cut, and one of their cable huts was entirely destroyed by the bombardment by the American fleet. It was with a feeling of pride and satisfaction that he could say that the staff kept to their posts under most trying circumstances.

When the Americans entered Santiago, after the capitulation on July 7, they were surprised to find the cables working, but, on learning that they belonged to an English company, they contented themselves with sealing them up, thus stopping the traffic for three weeks. The victors would have acted very dif-

Digitized by Google

ferently had the company been a Spanish one, so the shareholders should be thankful for small mercies. The company had granted their servants, who stayed at work during the war, an increase of pay, as the price of living reached an abnormal level. Since the termination of hostilities the company had been able to repair most of the damaged cables. They asked the assistance of the Foreign Office to obtain for them suitable compensation from the American Government. He was certain that the Foreign Office would do its utmost to assist them, but he could not say that their claim would be admitted. The gross income for the six months was $167,520, as against $118,115 in the corresponding period of the previous year, and the expenses amounted to $40,455, as against $35,025. He reminded the shareholders that the increase in receipts was owing to a special cause that was not likely to occur again, and remarked that they must rely upon peace to give them dividends. In reply to questions, the chairman stated the board would be very disappointed if the subsidy were not continued, and at present they saw no chance of losing it. The report was adopted.

Talked Over a 1,900 Mile Circuit.

According to a press dispatch from Little Rock, Ark., an extraordinary long distance telephone test has been made there by President Charles J. Glidden, of the Southwestern Telegraph and Telephone Company, who held a conversation over the wire with Frederick A. Farrar, of Poor & Greenough, Boston. The distance from Little Rock is 1,900 miles. Mr. Glidden says this is the longest circuit in the world, and the talking was excellent.

ICELAND. An English subsidy to a Danish cable company reaching Iceland is to be asked. An Anglo-Canadian syndicate will probably complete the line to Frederickhaab, Greenland, and thence on to Newfoundland.

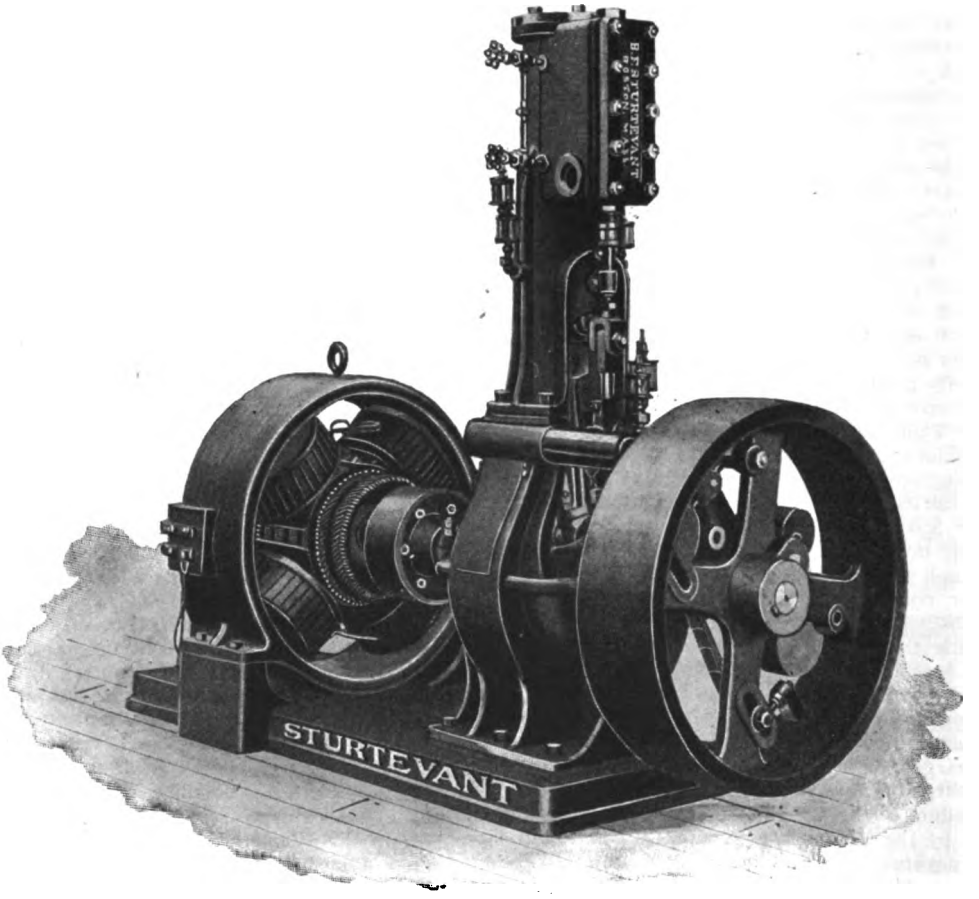
BRAZIL, IND. The Electric Haulage and Manufacturing Company has been formed, with a capital stock of $10,000, by J. H. McClelland, E. C. Morgan and C. B. Niblack.

Sturtevant Vertical Engine and Four-Pole Generator.

WE illustrate herewith in perspective and by diagram the automatic single upright engines and direct connected four-pole generator now being built by the B. F. Sturtevant Co., of Boston. The types of single engine here shown have balanced piston valves, thorough oiling devices and regulators designed for close control of speed; and they are built for high and low steam pressures.

The armature of the Sturtevant multipolar machine is of the barrel-wound type. The cast-iron flange, bolted to the armature spider at each end of the core, forms a support as well as a cylindrical receptacle for the projecting ends of the coils. The flange extension also protects the windings from any oil that may be thrown from the bearings. The surface of the interior of the armature is perfectly smooth, offering no opportunity for the collection of oil or dust. Ventilation is effected by the use of specially constructed vanes, forming air ducts between the laminæ of the core. These convert the armature into a blower and create a strong draft through the windings.

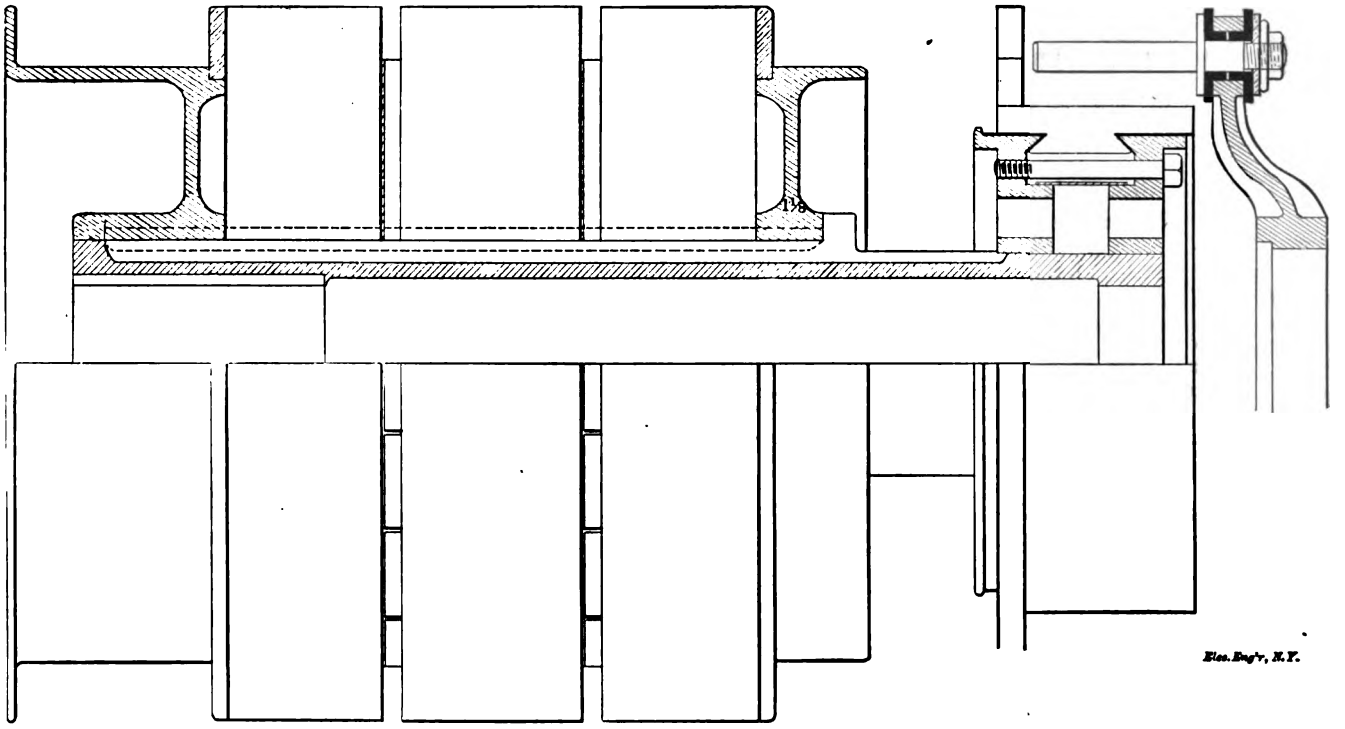
These generators are at present built in nine sizes, from 8 k. w. at 1,200 revs. per minute and a weight of 750 pounds, up to 100 k. w. at 600 revs. and a weight of 8,000 pounds. The details of construction are shown fully in the diagrams herewith. The generators can, of course, be built for higher or lower speeds and for belt connection, and can be compound wound for 125, 250 or 500 volts.



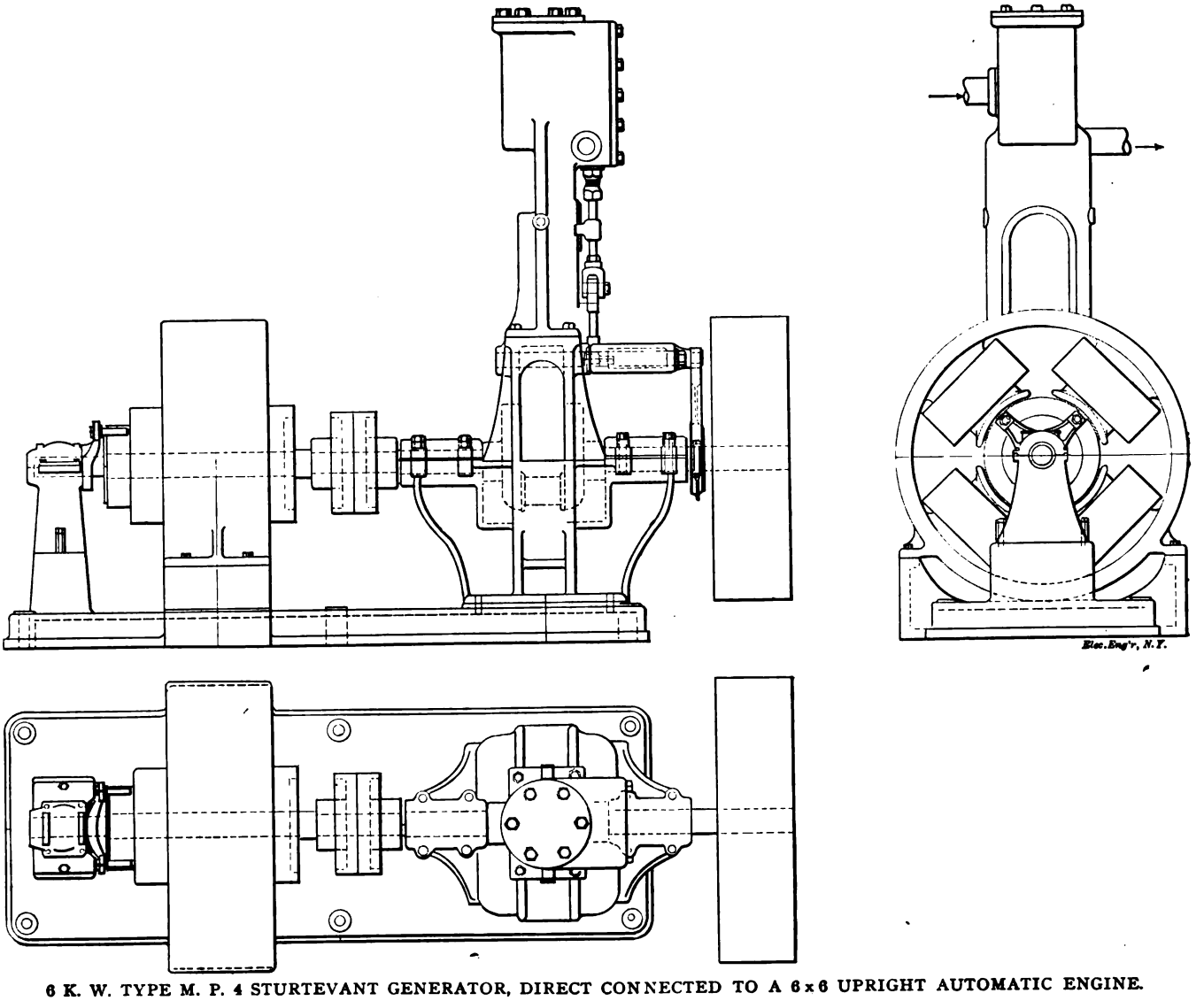
STURTEVANT GENERATING SET WITH VERTICAL ENGINE AND FOUR-POLE GENERATOR. (See page 621.)

MR. JOSEPH LEITER is said to have acquired complete control for foreign countries of the Hoadley-Knight compressed air patents, and to be organizing an English syndicate.

Digitized by Google



SECTION OF ARMATURE, COMMUTATOR AND BRUSH HOLDER OF STURTEVANT TYPE M. P. 4 GENERATOR.



6 K. W. TYPE M. P. 4 STURTEVANT GENERATOR, DIRECT CONNECTED TO A 6x6 UPRIGHT AUTOMATIC ENGINE.

Digitized by Google

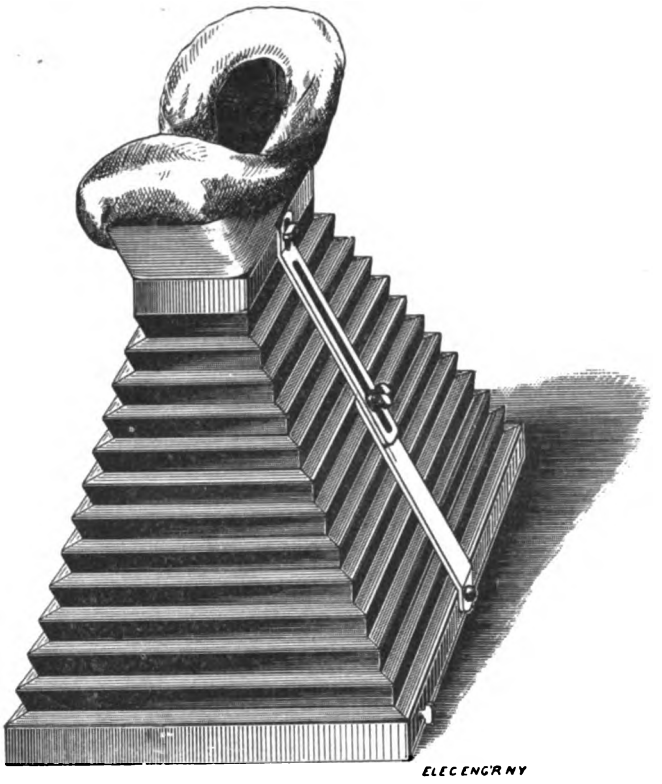
ROENTGEN RAYS

The Kolle Telescopic Fluoroscope.

BY F. S. KOLLE, M. D.

WHILE considering the possibilities of an X-ray outfit, to be used in times of war, and knowing that space and durability were to be earnestly considered, I devised, April 22, 1898, the following fluoroscope, to take the place of the bulky, stiff affair now so generally used by all radiographers, and when I look at the compactness, lightness and elegance of the new instrument, I wonder why "Mother Necessity" had not impelled some other mind to produce it.

The instrument is constructed as follows: The base is made of three sections, to wit: A sheet of aluminum, at the outer or exposed side; next to this is placed the cardboard mounted with tracing paper or linen properly coated with the fluorescent chemical, while beyond this, to prevent injury to the latter, is



KOLLE TELESCOPIC FLUORSCOPE.

placed a thin sheet of colorless gelatin, mica or celluloid. The whole is affixed to a shallow light wooden frame; to the upper rim a leather or black linen telescopic body is attached, constructed as in the camera, and so made to fold downward, having at its optic outlet a ⅜-inch wooden piece containing the soft black felt eyepiece. A brass attachment is so arranged by small thumb screws, to retain the whole in position when open, and to be put alongside of the base when closed. The latter also answers for a suitable handle, as well as supporting the whole at either side.

When closed, the entire width of the instrument covers about three-quarters of an inch, its screen area varying, of course, with the size selected.

Not only is this fluoroscope a suitable and satisfactory instrument for transportation, but it is at once a compact and more finished apparatus for office work than the former box form, inasmuch as it is, in its finished state, both handsome and efficient. Furthermore, the fluorescent screen proper may, in this instrument, be brought as near to the operator's eyes as he desires, ofttimes a disadvantage in the ordinary fluoroscope.

SOCIETY & CLUB NOTES

Line and Engineer Officers in the Navy.

A League of Associated Engineers, with headquarters at the Engineers' Club, has taken up the House Bill, No. 10403, now before Congress, the object of which is to unify the personnel of the navy and marine corps by eliminating the existing distinctions between line and engineer officers. The advantages of this reform are thought to be so obvious that little opposition is expected, but as there may be some, and as the calendar is crowded, the league invites the co-operation of engineers in pushing the measure. An executive committee of a very influential character has been formed comprising as chairman, Mr. S. W. Baldwin, past vice-president Am. Soc. Civ. Engrs.; Mr. C. Kirchhoff, president Am. Inst. Min. Engrs.; Mr. C. W. Hunt, past pres. Am. Soc. Mech. Engrs.; Mr. John Thomson, president Engrs.' Club; Mr. Chas. H. Loring, past president Am. Soc. Mech. Engrs.; Dr. Louis Duncan, past president Am. Inst. Elec. Engrs.; Mr. E. P. North, vice-president Am. Soc. Civ. Engrs., and Mr. W. A. Redding, Board of Managers, Engrs.' Club. Beyond the inauguration of the movement the Engineers' Club is not responsible for the acts of the committee, but is understood to be actively interested in the success of this very laudable movement.

New York Electrical Society.

THE 192d meeting of the New York Electrical Society, at the College of the City of New York, on Wednesday, Dec. 14, brought a crowded house. The subject of the evening, which was treated by Colonel Eugene Griffin, of the First Regiment of U. S. Volunteer Engineers; Mr. W. D. Weaver, late Chief Engineer of U. S. S. S. "Glacier," and Mr. F. W. Roller, late Chief Engineer of U. S. S. S. "Nashville," was "Electrical Engineers in the War."

Colonel Griffin's soldierly and fascinating address was listened to with rapt attention, and conveyed a concise and comprehensive view of the organization and operations of the corps with which he has been so honorably associated. While referring to the inception of the idea of a volunteer engineer corps, which was first given to the public on Oct. 23, 1890, by Lieut. B. A. Fiske, U. S. N., in a paper before the New York Electrical Society, on "The Civilian Electrician in Modern War," Colonel Griffin gave generous recognition to the work of Mr. Caryl D. Haskins in the formation of the Volunteer Engineers. The corps went to Porto Rico with 48 officers and 1,097 men, and returned with 47 officers and 857 men. The saddest feature of the campaign was the loss by death of one officer and thirteen men. The work done by the regiment was of a far more comprehensive character than is generally realized: it included topographical surveys of the intended line of march, the hydrographical surveys of the harbors of Ponce and Guanica, the rebuilding of fine masonry bridges by the destruction of which the Spaniards imagined they had stayed the advance of the invading army; the building of a dock and commissary storehouses; the setting up of an ice plant and refrigerating plant for the general hospital at Ponce, and the construction of buildings for the purpose; the establishment of a water supply system; the reconstruction of forts, and innumerable other services. Enough was done, in fact, to demonstrate the immense value of the regiment, and Col. Griffin's suggestion that the scope of the Volunteer Engineers should be greatly extended, without delay, and the establishment of a permanent corps be taken in hand forthwith, seems likely to secure consideration at Washington. Col. Griffin's proposal is that in the army of 100,000, the organization of which Congress is now considering, there should be at least four regiments of engineers. Col. Griffin does not hesitate to say that engineers, including tradesmen, make better soldiers than any other class of men. Their standard of intelligence and special skill is necessarily high, and they are well fitted to meet the enemy under all conditions, either offensive or defensive.

After Col. Griffin's address, Mr. Roller spoke on "Electrical and Engineering Work in the Navy During the War." In drawing attention to the weak points of naval electrical application.

Digitized by Google

he showed where the remedy lay, and his address formed a valuable contribution to the record of the lessons of the war from an electrical point of view Mr. Roller considered the searchlight the great success of the war, and said that had it not been kept steadily every night on the mouth of Santiago Harbor, Cervera's torpedo boats would have made things distinctly unpleasant for the American men-of-war; the blockade would have been broken, Cervera would have got safely away to Havana with his fleet, and the war would not yet be over.

Lieut. W. D. Weaver's paper which, in the unavoidable absence of its author, was read by Mr. Roller, gave the deductions made by Mr. Weaver from his experience at the front. While stating that the range-finder, and some other electrical appliances, are too delicate in their present form to withstand the rough usage incidental to a sea fight, and the fearful concussion of heavy gun firing, Mr. Weaver was of opinion that after some modification and improvement, they could be brought to a point of practical usefulness and great efficiency. The paper is printed on page 616.

This highly successful and largely attended meeting was brought to a close by a few remarks by Capt. E. L. Zalinski on the work of the "Vesuvius."

Sixth Annual Meeting of the Underwriters' National Electrical Association.

THE sixth annual meeting of the Electrical Committee of the Underwriters' National Electrical Assn. was held at the rooms of the New York Board of Fire Underwriters on Dec. 6, 7 and 8. Besides the members of the committee, there were present the electrical inspectors of insurance organizations and municipal inspectors from all parts of the United States, to the number of about forty. The time of the meeting was largely given up to technical matters, such as the formulating of specifications for standard fittings and devices, such as sockets, transformers, switches and cut-outs. Some few slight changes were made in the rules embraced in the National Electrical Code. A committee of seven, consisting of W. H. Merrill, Jr., of Chicago; E. V. French, of the Factory Mutuals; Wm. McDevitt, of Philadelphia: A. M. Schoen, of Atlanta, Ga.; J. C. Forsyth, of New York City; Jas. E. Cole, of the Boston Wire Department, and Mr. Ellicott, of the Chicago Wire Department, was appointed to meet in Chicago at an early date to take up among other questions, specifications for tests on approved rubber covered wires.

The reports of the gentlemen present seemed to indicate that the publication of the List of Approved Electrical Fittings by the National Board of Fire Underwriters had been of great value, and that its usefulness could be largely increased if it was more uniformly enforced, and to that end the following resolutions were adopted:

Whereas the attention of members of the sub-committees in consulting with manufacturers has been repeatedly called to the fact that the establishment of standard specifications and the publication of our list of approved fittings and materials, which is intended to be, and if lived up to, is capable of being of great value and assistance not only to the insurance interests, but also to the electrical manufacturing supply and construction interests, becomes, if not lived up to, as great an injustice to the last-named parties as it might have been a benefit; and

Whereas we believe it to be the duty of insurance interests, in justice to such persons as are engaged in the manufacture and distribution of such devices and materials, to give them our heartiest support when they endeavor to furnish the market with reliable goods; and

Whereas the uniform support of all of the inspection departments in approving only such devices and materials as are properly designed for the use to which they are put, is the quickest and surest way of ridding the market of poor and undesirable articles; and

Whereas it would seem that the strict enforcement of the list of approved fittings and materials will be of benefit to and is desired by not only the insurance interests, but also by all reputable parties connected with the electrical interests and that it will work no injustice nor hardship to any interested parties;

Therefore be it: Resolved, That it is the sense of this meeting that on and after July 1st, 1899, all inspectors should refuse to accept any devices or materials on new work not enumerated in the edition of the list of approved devices and materials of the above date.

Resolved, That the secretary of this committee be instructed to correspond with the various underwriters' associations asking that they agree to adopt the above resolutions.

Resolved, That we each and all pledge ourselves to urge upon our respective associations the prompt adoption of these resolutions.

Resolved, That the secretary of this association be instructed to give these resolutions the greatest possible publicity by furnishing them to the electrical and insurance press and by furnishing copies of the same to all inspectors for distribution in their respective territories.

The Electrical Trades Society of New York.

At a meeting of the Electrical Trades Society of New York, held at the Astor House, New York, Dec. 6, it was voted to incorporate the society under the laws of New York State. Mr. A. P. Eckert reported that fourteen new members had been enrolled during the past year, and that the funds of the society were in good shape. The following gentlemen were duly elected as directors of the incorporated society: R. E. Gallaher, C. P. Geddes, P. C. Ackerman, E. R. Gilmore, J. B. Peck, H. A. Reed, J. P. Marshall. At the directors' meeting held immediately after the adjournment of the regular meeting, the directors appointed the following gentlemen as officers of the society: R. E. Gallaher, president; C. P. Geddes, vice-president, and A. P. Eckert, secretary and treasurer.

Connecticut Electric Lighting Association.

THE annual meeting of the Connecticut Electric Lighting Association was held at New Haven, Saturday, Dec. 17, being called at the office of the New Haven Electric Light Co. at 11 o'clock. The following officers for the ensuing year were elected: President, James English; first vice-president, C. A. Learned; second vice-president, C. H. Nettleton; treasurer, A. M. Young; secretary, A. F. Hunie, after which Prof. W. L. Robb read a paper on the use of rotary transformers and the use of storage batteries by the Hartford Electric Light Co., and H. L. Purrington a paper on the merits and demerits of the Welsbach lamp, both of which proved very interesting and called out considerable discussion.

After the meeting a sumptuous dinner was provided at Trayer's Hotel. The following were present: John Workman and F. F. Fuesenick, Torrington; H. L. Mansfield, Middletown; H. O. Shepardson and F. H. Golding, Brandford; Geo. Terry, H. M. Young and L. W. Sweet, Waterbury; F. L. Terry, New London; Samuel Hurlburt, Norwich; H. J. Purrington, Stamford; L. S. Catlin, Bridgeport; C. H. Learned, Meriden; Thomas C. Perkins, Mystic; G. E. Cowperthwait and B. A. Hough, Danbury; Prof. W. L. Robb, Hartford; C. H. Nettleton, Derby; James English, A. F. Hunie and W. G. Bushnell, New Haven; G. G. Blakeslee, Naugatuck; R. Crawford, Stamford.

Exports of Electrical Material from New York.

The following exports of electrical material are from the port of New York for the week ending Dec. 6: Alexandria—6 cases electrical machinery, $947. Argentine Republic—6 packages electrical material, $481. British East Indies—11 cases electrical material, $280. British Australia—28 packages electrical material, $376. Brazil—101 packages electrical material, $912. Berlin—3 cases electrical material, $60. British Possessions in Africa—10 cases electrical material, $280. Bremen—6 cases electrical material, $280. British Australia—23 packages electrical material, $150; 1 package electrical material, $12. British Guiana—27 packages electrical material, $650. Cuba—9 packages electrical material, $113. Central America—1 case electrical material, $160. Ecuador—1 case electrical material, $34. Florence—1 case electrical material, $50. Glasgow—18 cases electrical material, $1,438. Hamburg—72 cases electrical material, $3,276; 12 cases electrical material, $3,345; 1 case electros, $25. Havre—68 cases electrical material, $2,741. Helsingfors—

Digitized by Google

8 cases electrical machinery, $500. London—212 packages electrical material, $7,124; 87 packages electrical machinery, $12,310. Liverpool—8 packages electrical material, $1,893. Leeds—11 cases electrical material, $367. Mexico—40 packages electrical material, $1,837. Milan—28 cases electrical material, $11,400. Manchester—3 cases electrical material, $110. Moscow—8 cases electrical material, $428. Newfoundland—7 cases electrical material, $125. Naples—5 cases electrical material, $255. Oporto—36 cases electric motors, $5,600. Preston—1 package electrical machinery, $10. Stockholm—1 case electrical material, $386. St. Petersburg—17 packages electrical material, $623. Southampton—2 cases electrical material, $17; 18 cases electrical machinery, $343. U. S. of Colombia—4 cases electrical machinery, $300; 2 packages electrical material, $17. Venezuela—7 cases electrical material, $227.

Demand for American Electrical Goods in Brazil.

A traveling representative of the Philadelphia Commercial Museum, who has recently returned from Brazil, has made the following report on the trade in electrical goods in Brazil:

"The electrical goods trade of Brazil is growing by leaps and bounds, it being only a few years ago that electrical trams, lighting, power, etc., were unknown in any part of the country. Now almost every town and city within three hundred miles of the coast is either lighted by electricity or has the project under consideration. Many of the mining companies and cotton cloth mills through the interior have plants now in operation, supplying them with both light and power. Several of the large plants have come from England. The United States comes in for a fair share of the trade in electrical machinery.

"Arc and incandescent lamps, fittings, carbons, wire of all kinds, electric bells, batteries, electricians' tools and gloves, zincs, sal-ammoniac, etc., are in demand in the towns along the line of the Central Railroad between Rio and Sao Paulo, and Rio and Bello Horizonte, as these towns at present rely on the Rio merchants for their supplies.

"At Juiz de Fora another electrical plant is installed, and here another agency for sundries would do well in supplying not only Juiz de Fora and the adjoining town of Marianna Procopio, but also the towns on the lines of the west of the Minas and Laopoldina railroads, which intersect the Central Railroad at Sitio and Areal, both near here.

"Along the line from Rio to Sao Paulo are also many towns in which it might be advantageous to have agents. A competent salesman, familiar with the Portuguese language, traveling through this section could do wonders in the way of securing orders and appointing responsible agents.

"This may also be said of nearly all the interior cities, as attention so far has seemingly been paid only to the large cities on the coast, and even there not to the extent the trade possibilities deserve."

WESTINGHOUSE ELEC. & MFG. CO. has declared its regular quarterly dividend of 1¾ per cent. on its preferred stock.

OBITUARY

James Brown.

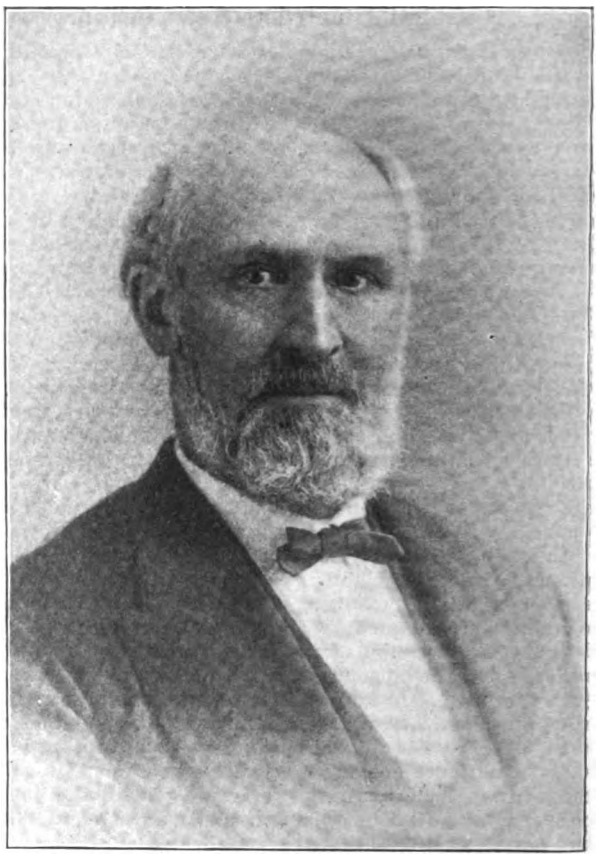
We regret deeply to note the sad fact that Mr. James Brown, superintendent of the Direct U. S. Cable Co., died at his late residence, 15 West 103d street, New York, Saturday morning last after a brief illness. Mr. Brown was born in Keith, Banffshire, Scotland, and at an early age obtained a position with the Electric & International Telegraph Co. in Aberdeen. When the telegraph companies were absorbed by the British Government in 1870 he was engaged in the meteorological department of the general post office of Aberdeen. He came to this country in September, 1874, and has been identified with the Direct Cable Co. since its inception, becoming superintendent in 1884. He was well known and greatly liked in telegraphic circles, especially in the downtown district. He leaves a widow and two children. The funeral services were held at his residence on Dec. 20, and the interment took place at Kensico Cemetery. The Direct has lost a vigilant and faithful servant.

PERSONAL

Mr. William C. McDonald.

THE one man who has distinguished himself of late years by his munificent gifts in behalf of electrical engineering studies, is a Canadian, Mr. William C. McDonald, of Montreal, upon whom, as we noted editorially last week, the Queen is bestowing the honor of knighthood in recognition of his liberality toward McGill University. The London "Times" in a recent comment says: "The claim that the engineering and physics departments of McGill are the most perfectly equipped in the world seems justified to any one who has inspected the fine buildings in which they are installed. Both are the gift of another generous citizen of Montreal, Mr. W. C. McDonald, who has spent upon them nearly a million dollars." As a matter of fact, he has given now, all told, $2,300,000.

Mr. McDonald is the youngest son of the late Hon. Donald McDonald, some time president of the Legislative Council of



MR. W. C. McDONALD.

Prince Edward Island, by his wife, Ann Matilda Brecken, of Charlottetown, and is grandson of Capt. John McDonald, eighth chief of the Clan Macdonald, of Glenaladale, who after founding the Scotch settlements at Tracadie, Scotchfort, Glenfinnin and Fort Augustus, P. E. I., served during the American revolutionary war as a captain in the 84th, or Royal Highland Emigrant Regiment. Born at Glenaladale Tracadie, P. E. I., 1833, he was educated at the Central Academy, Charlottetown, and obtained his business training in that city under the late Hon. Daniel Brennan. He left Prince Edward Island in 1854, and removed to Montreal, became an importer and general commission merchant there. Subsequently he embarked in business as a tobacco merchant and manufacturer, and now owns extensive works in that line in Montreal. He is a governor of McGill University, a governor of the Montreal General Hos-

Digitized by Google

pital, and a director of, and the largest shareholder in, the Bank of Montreal. He is also a vice-president of the Montreal branch of the St. John Ambulance Association, and an honorary member of the Architects' Association, Province of Quebec. He is known chiefly through his princely gifts to McGill University. These consist of $20,000 to the Thomas Workman endowment for mechanical engineering; the erection of the W. C. McDonald Engineering Building, valued, with its equipment, at $350,000, and an endowment for its maintenance; the endowment of the chair of electrical engineering with the sum of $40,000; the erection and equipment of the Physics Building, valued at $300,000, and two chairs of physics with endowments amounting to $90,000; the endowment of the Faculty of Law with $150,000; a further sum of $150,000 for the maintenance of the Engineering Building; $50,000 towards the endowment of the pension fund, and the erection of a new building for the Department of Chemistry, Mining and Architecture, at a cost of $500,000. Mr. McDonald belongs to a Roman Catholic family, and is unmarried.

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued Dec. 6, 1898.

Alarms and Signals:—

BLOCK-SIGNAL SYSTEM. William L. Stockton, Trenton, Ohio, 615,584. Filed Dec. 20, 1897. Employs a short circuit to operate a lamp at either end of a block while a car is on that section.

Batteries, Primary:—

ELECTRIC BATTERY. Owen T. Bugg, Jr., New York, N. Y., 615,246. Filed March 15, 1898. Comprises a casing and perforated interior cylinder of conducting material, a mass of active material packed between them, and a zinc electrode fastened to the cover of the casing.

ELECTRIC BATTERY. Maurice Maas, New York, N. Y., 615,292. Filed Sept. 7, 1897. Comprises a zinc, a hollow carbon provided with a longitudinal recess, a binding-post provided with a shank fitting the recess and with an opening in that end, a binding wire passing around the carbon and through the opening in the shank, and a copper plating covering the uppper part of the carbon, binding-post and binding-wire.

ELECTRIC BATTERY. Philip Albert Emanuel, Aiken, S. C., 615,539. Filed May 17, 1898. Comprises positive and negative elements having passages through them, a porous body separating the elements, the porous body being impervious to a fluid where it registers with the passage through the elements, an exciting fluid and means for forcing the fluid through the porous body.

ELECTRIC BATTERY. Philip Albert Emanuel, Aiken, S. C., 615,540. Filed May 17, 1898. Similar to above.

ELECTRIC BATTERY. Philip A. Emanuel, Aiken, S. C., 615,541. Filed May 17, 1898. Similar to above.

Conductors, Conduits and Insulators:—

ELECTRIC CABLE CONDUCTOR. Stephen Dudley Field, Stockbridge, Mass., assignor to the American Bell Telephone Co., Boston, Mass., 615,349. Filed Dec. 24, 1897. Composed of insulated wires of an electrical circuit, and one or more iron companion wires not included in the circuit, but interbraided with the others.

ELECTRICAL CONNECTION. William E. Baker, Chicago, Ill., assignor to Carter H. Fitzhugh, Chicago, Ill., 615,420. Filed July 13, 1896. A flexible detachable connection designed for use between two cars.

BINDING-POST. John P. Jones, Webster, Pa., assignor of one-half to J. W. Blower, Webster, Pa., 615,455. Filed May 7, 1898. Comprises a body portion having a bearing-plate with an opening formed therein, a socket having a plate with a stud extending therefrom adapted to enter the opening, a nut on the stud and a spring interposed between the nut and bearing-plate.

Dynamos and Motors:

ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE. Sebastian Ziani De Ferranti, Hollinwood, England, 615,265. Filed Dec. 28, 1897. Embodies separately insulated supports for the bobbins employed in an alternating current disk armature.

DYNAMO-ELECTRIC MACHINE. John E. Fuller, New York, N. Y., assignor to Caleb Coles Dusenbury, Lake Mahopac, New York, 615,351. Filed March 24, 1898. Especially intended for developing electricity for an incandescent lamp upon a cycle, the armature being driven by a connection to one of the wheels.

Lamps and Appurtenances:—

ELECTRIC ARC LAMP. Moses S. Okun, New York, N. Y., 615,407. Filed June 3, 1895. Feed mechanism for enclosed arc lamps.

ELECTRIC ARC LAMP. Moses S. Okun, New York, N. Y., 615,408. Filed Oct. 21, 1895. Renewed May 28, 1898. Comprises a globe closed below the arc, and a disk fitting snugly within the globe so as to travel up and down therein with the upper carbon to retard the access of air to the arc.

Miscellaneous:—

ELECTRICAL APPLIANCE FOR ELEVATORS. James H. Roberts, Grand Rapids, Mich., 615,365. Filed Dec. 27, 1895. Automatic safety switch for electric elevators. Details of construction.

REFLECTOR. Albert E. Boeschenstein, St. Louis, Mo., assignor to the Manhattan Electric Co., St. Louis, Mo., 615,471. Filed Feb. 28, 1898. Comprises a longitudinally-disposed bracket, a removable support having lamp-supports secured to, but insulated from it, and electric lamps having terminals at opposite ends which are received in the lamp-support, one lamp-support being common to two lamps.

HIGH-FREQUENCY APPARATUS. Thomas B. Kinraide, Boston, Mass., 615,652. Filed May 13, 1897. An induction device provided with a primary having a plurality of turns and means to shift the circuit connection from one turn to another transversely of the turns, at either or both ends of the coil at will.

HIGH-FREQUENCY INDUCTION APPARATUS. Thomas B. Kinraide, Boston, Mass., 615,653. Filed March 4, 1898. Comprises a secondary in the form of a flat coil, and a primary in the form of a flat coil, superimposed flatwise and coaxially one on the other, the primary being in the form of an annulus having a large central aperture relatively to the coaxial secondary.

Railways and Appliances:—

ELECTRIC LOCOMOTIVE. Martin E. Thomas, Cassaday, Ky., assignor of three-fourths to W. F. Toops, and H. L. Hendrick, Bowling Green, Ky., 615,592. Filed July 12, 1897. Of the Heilmann type.

ELECTRIC LOCOMOTIVE. Samuel M. Vanclain, Philadelphia, Pa., 615,594. Filed Dec. 29, 1898. Embodies a shaft having a crank thereon and extended sleeve, and a driving-wheel secured to the sleeve.

Switches, Cut-Outs, Rheostats, Etc.:—

ELECTRIC SWITCH. William Ely, Providence, R. I., 615,347. Filed Aug. 14, 1896. A knife-switch in which the make and break is assisted by springs.

APPARATUS FOR OPERATING ELECTRIC SWITCHES. Charles Hartdegen, Newark, N. J., 615,388. Filed July 30, 1897. Comprises an electric switch having a contact-plate and an arm extending therefrom; a timepiece, its train of gear mechanism, its winding-arbor, and a helix on arbor engaging with the arm on the contact-plate, to actuate it to close the switch.

CIRCUIT-BREAKER. Frederick A. LaRoche, New York, N. Y., 615,395. Filed Dec. 28, 1897. Details of construction.

AUTOMATIC RHEOSTAT. Eleazer T. Wilkinson, Philadelphia, Pa., 615,418. Filed May 8, 1897. Employs working solenoids to actuate the cut-off mechanism.

RHEOSTAT. Charles Wirt, Philadelphia, Pa., 615,419. Filed July 26, 1897. Comprises a casing having a continuous electrical conductor folded within it, fixed contact-pieces intermediate of the folds, a movable contact member mounted upon casing, and means to shift the member in direct contact with the successive folds of the conductor.

SWITCH-CONTACT. Monroe Guett, Hartford, Conn., 615,665. Filed May 23, 1898. Consists of a spring doubled on itself into a plurality of arms, one arm having an opening therein, and a connection between the sides of the arm adapted for attachment to a support.

Telephones:—

TELEPHONE. Franz Burger and Henry M. Williams, Fort Wayne, Indiana, said Burger assignor of one-half to said Williams, 615,344. Filed Aug. 16, 1897. Comprises a bar, a slidable handle mounted on the bar, contacts controlled by the slidable handle, and a cross-piece supporting the telephone instruments.

THE STOCK MARKET

A "Boom" without Boom Features.

When a man is taking in two dollars for every dollar he spends, and keeps it up, his finances and general condition are in the best possible shape. That is just what is true of the United States after years of suffering, economy and depression; and it unfolds a great many assurances of continued and growing prosperity through a series of years. American international trade is now permanently favorable owing to the development of our manufactures not less than agriculture, and the settlement of the financial issue has assured the business man as to the future in all that concerns domestic affairs. At the present moment, the iron trade is in a state of unprecedented activity and many other lines approach it in cheerful prospects. As to retail trade, the reports from all centres bear testimony to large holiday buying and to universal briskness.

Last week Wall street broke all records for large transactions in stocks and bonds, and in many securities the highest levels for years past were reached and held. Western Union declared its regular quarterly dividend of 1¼ per cent. and on sales of 24,488 shares closed at 94½. General Electric, new, on sales of 23,151 shares, went to 95 and closed at 92¾. New York Edison, which has gone up $60 per share in the last month or two, closed at 190¼ on sales of 3,636 shares. Metropolitan Street Railway also holds on at high levels, and on sales of 29,215 shares closed at 191½. In Boston, Am. Bell Telephone eased off from 280 to 277 chiefly on the new local opposition, and West End Railway was firm at 89¾.

Copper, New York, was quoted at 12.75 cents; heavy steel rails, Eastern mill, $17; lead, New York, 3.70 cents.

ELECTRIC STORAGE BATTERY CO., Philadelphia, Pa., has made arrangements, it is said, to double the capacity of its factory. The demand for batteries is enormous.

Digitized by Google

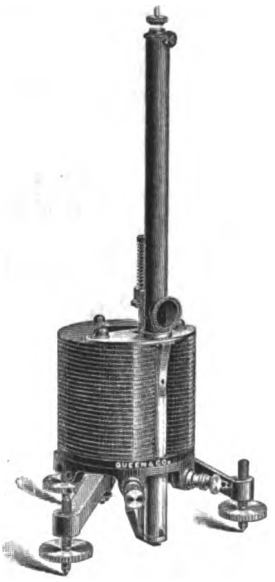
TRADE NOTES AND NOVELTIES

High Grade Electrical Measuring and Testing Instruments, X-Ray Apparatus and Other Scientific Instruments, as Made by Queen & Co., Inc., of Philadelphia.

IT is probable that in no branch of electrical engineering has there been employed a higher degree of technical talent than in the design and manufacture of electrical measuring and testing instruments, now regarded as essential auxiliaries in all electrical industries.

Industrial processes and technical applications, in their conception crude, advance at first by the expensive process of trial and error, but soon reach a point where unerring calculation is necessary to offer to investors the security desired. The history of the electrical industry in America is marked by rapid strides, overreaching the older countries in the wideness and boldness of its application. So impetuous has this been that to-day in many fields we are reaping the inevitable result of hasty action and mistaken judgment, and now the process of renovation has become nearly as important a factor as the production of new work.

This condition, conducive as it is to more conservative action



QUEEN GALVANOMETER.

QUEEN-WIRT ROUND PATTERN VOLTMETER.

QUEEN-WIRT ILLUMINATED DIAL VOLTMETER.

and more careful planning, has rendered necessary the employment of talent specialized to some line, and has called for precise methods and apparatus. As the perfection of the steam engine has depended on the steam engine indicator, so has the refinement of electrical industries been brought about by the refinement of testing, and the precision of measuring instruments.

During the earlier period these instruments were imported from Europe, but the difficulty, apart from the delay, was that they were ill-adapted to American requirements where the methods and application have often differed from those abroad. Fortunately for the professions the need of importing is no longer felt, since we now have in this country tools and machinery especially suited to manufacturing the very precise instruments which are required in refined technical processes, and talent to create the apparatus.

In the works of Queen & Co., who are the largest manufacturers of scientific instruments in the United States, will be found all the requirements for accurate work. To emphasize the marvelous facilities enjoyed by this company in high grade tools, skilled workmen, and reliable standards for producing electrical instruments, we shall outline the wide range of products manufactured and describe briefly the equipment.

The main building, in which are located offices, salesrooms, stock rooms and the manufacturing departments of some of the more refined processes, is located at 1010 Chestnut street, Philadelphia, and is a five-story white marble structure, running clear through to Sansom street. The metal-working, wood-working and glass blowing factories, and the adjusting laboratory, are located on Filbert and Hunter streets. The standardizing laboratory, optical factory, and lens factory, on Chestnut street.

The house embraces eight departments, each under the management of a head skilled in his line, many of whom are recognized authorities in their profession. There are the following eight departments: (1) Physical and Electrical, comprising electrical instruments, X-Ray and general physical apparatus. (2) Astronomical, comprising astronomical, telescope, projection and polarizing apparatus. (3) Microscopical, comprising microscopes and supplies for biological laboratories. (4) Optical, comprising optical and ophthalmological instruments, field and opera glasses. (5) Chemical, comprising chemical apparatus, balances and chemicals. (6) Mathematical and Engineering, including drawing instruments and material, engineering and surveying instruments. (7) Meteorological, comprising meteorological instruments, barometers, thermometers, pyrometers. (8) Photographic, comprising cameras, lenses and supplies. The apparatus and instruments of these departments are illustrated and described in different catalogues and circulars, aggregating about 2,000 pages, this literature alone sufficing to keep a printing establishment constantly running.

The thorough equipment necessitated by the diversified requirements of the various branches, insures that each department shall find in the one establishment facilities for every process demanded in its work, thereby keeping every operation under the eye of the department head. In making an electrical instrument nothing need be furnished from an outside source. The thermometer on the resistance box is made in the thermometer factory, the objective and eye-piece for the reading telescope are made in the lens factory, the galvanometer mirror is ground in the optical factory. Every operation, however trivial, is performed under the care of the man whose business it is to produce a complete and perfect instrument.

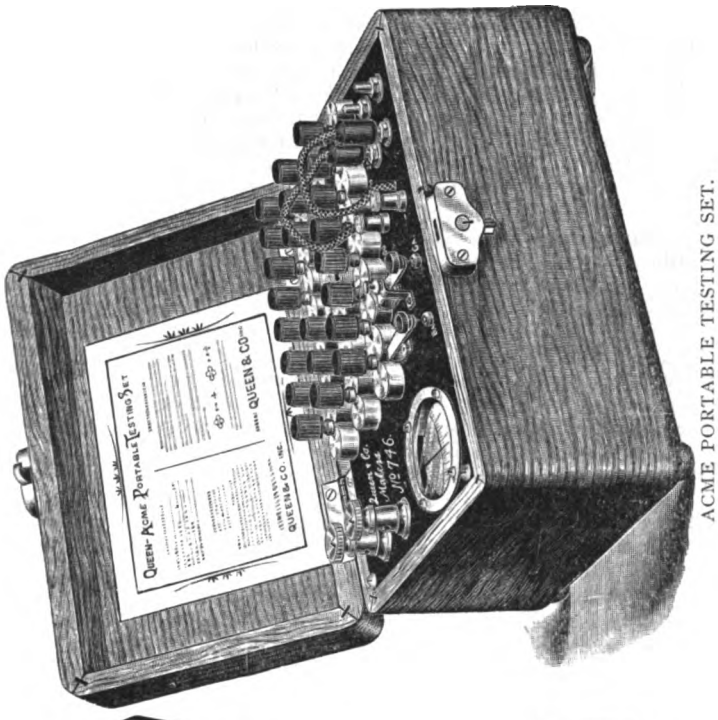
As before noted, the principal factories are located on Filbert and Hunter streets. In the glass blowing factory are made barometers, thermometers for industrial and scientific purposes, Geissler, Crookes and X-ray tubes. A large stock of imported glass is kept constantly on hand, as well as a supply of thermometers in process of seasoning.

In the wood working factory are made the various cases, supports, and parts of wood that are required by the various departments. Here the electrical instruments receive their highly finished mahogany cases and bases, and the engineering transits and levels their tripods and carrying cases.

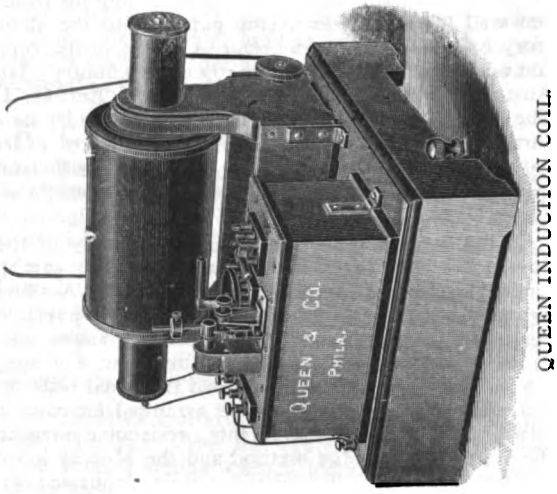
The metal-working factory, situated on Filbert street, occupies a floor space about 45 x 240 feet. The equipment embraces a very wide range of metal-working tools, many of which are designed especially for the company. Accurate comparators and circular and straight line dividing engine are employed. On these are graduated circles and verniers for transits, and here are produced standard meters, standard yards, and proportionate scales for engineering and architectural use. The precision of these dividing engines has assisted in putting Queen & Co.'s engineering instruments to the front as amongst the most accurate and reliable ones on the market. It might be interesting in this connection to state that many transits and levels are annually exported by this house, an interesting fact when one considers the active competition they must meet from the German and English instrument makers. But recently they completed a large order from the Russian Government for use on the Siberian Railway.

Adjoining this factory we find the adjusting laboratory, where all electrical instruments are completed, preparatory to standardizing. Here are four generators, static and rotary transformers, and a storage battery plant of the chloride accumulator type. By their aid direct and alternate current may be furnished on the calibrating boards, and practically any demand for calibrating purposes may be met up to 5,000 amperes, or 2,000 volts. In this laboratory are calibrated the well known Queen-Wirt meters. They are made in three types: illuminated dial, round pattern, and portable, for either direct or alternate current. All instruments are guaranteed as to accuracy and permanency, a certificate to that effect accompanying each one.

Digitized by Google

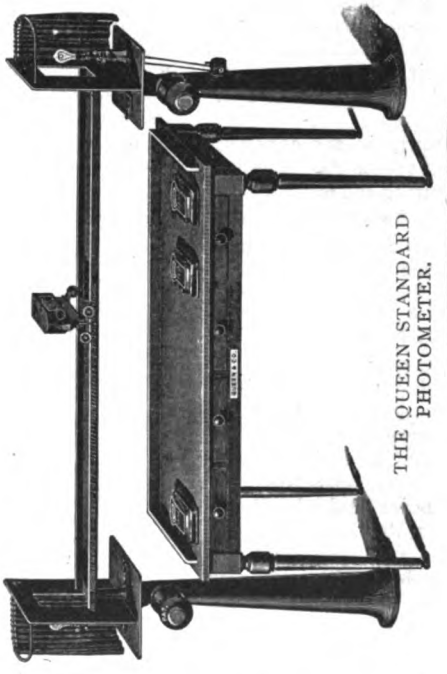


ACME PORTABLE TESTING SET.

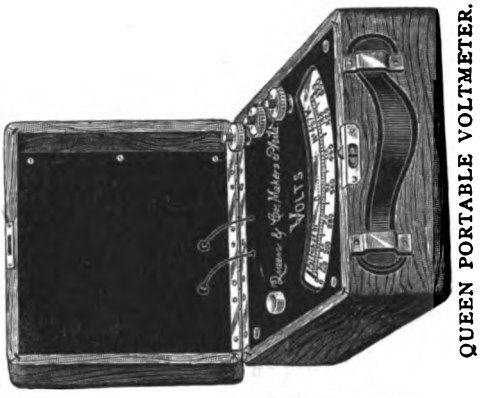


QUEEN INDUCTION COIL.

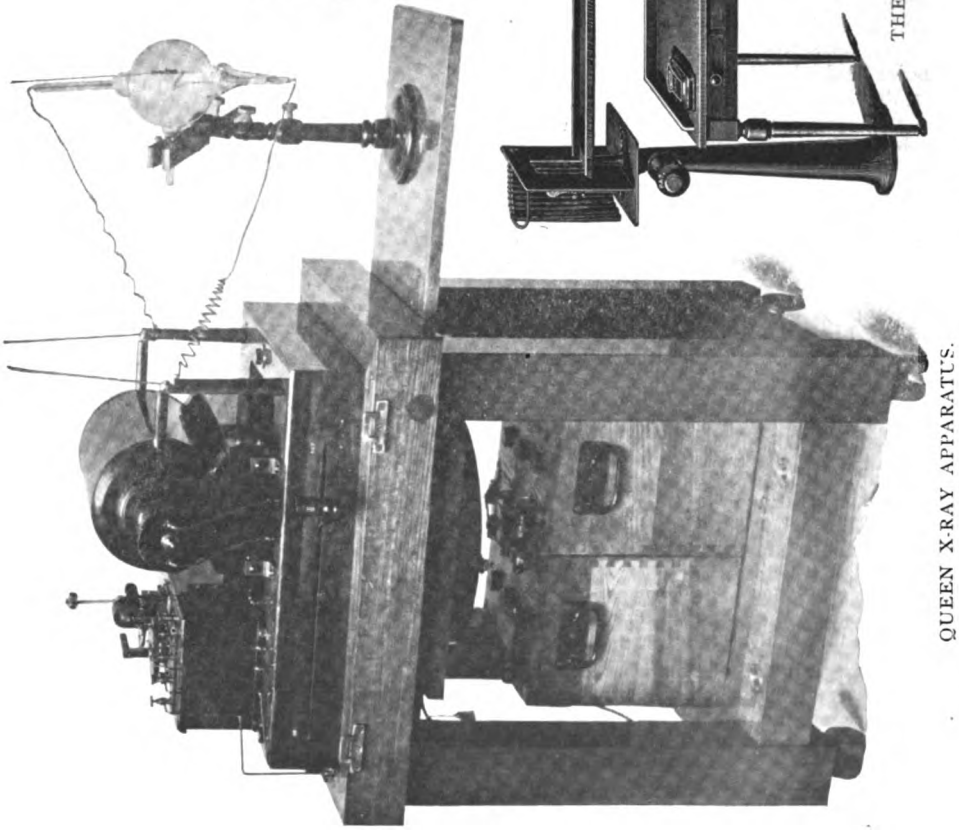
QUEEN PORTABLE METER.



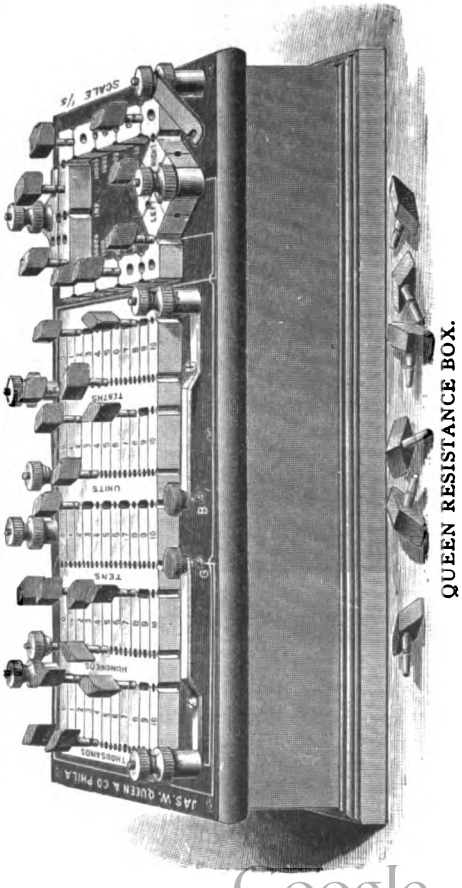
THE QUEEN STANDARD PHOTOMETER.



QUEEN PORTABLE VOLTMETER.



QUEEN X-RAY APPARATUS.



QUEEN RESISTANCE BOX.

Digitized by Google

We find also in the process of construction wattmeters, field rheostats, testing sets, resistance standards, cable testing apparatus, etc. Queen & Co. enjoy the reputation of being the only manufacturers of cable testing apparatus in this country. They produce outfits for every requirement, ranging from the simple and well known Queen Acme portable, to the elaborate laboratory outfits. The Queen Acme is in use in the central stations and telephone exchanges of nearly every country—Japan, Russia, Australia, South Africa, South America, Europe, Canada, etc. The chief advantage of the Queen Acme, besides its extreme accuracy and range, is that it never gets out of order, does not require any adjustment previous to use, and withstands shipment without injury. This set is in use on all the vessels of the United States Navy.

Of the more elaborate testing outfits many of the large stations and telephone exchanges in this country can speak, as the Queen instruments have become standard. An interesting instrument but recently produced is a complete portable cable testing outfit. It is contained in two strong cases, one measuring 10 inches x 15 inches x 8 inches; the other, 8 inches x 5 inches x 5 inches. With this apparatus all the usual tests may be made and with extreme accuracy. It is arranged for capacity measurements, insulation measurements, resistance measurements by the Wheatstone bridge method and the Murray loop test.

Another line that has been carefully elaborated by this establishment, is the manufacture of standards of light and photometers. Their photometers are of three types: Precision photometers, for laboratory and research work; industrial photometers, for lamp manufacturers and central station use, and portable photometers. The standards of light include the standard candle, the Methven screen, the amyl acetate lamp, and the incandescent lamp. Their standards are furnished with certificates of comparison with their Reichsanstalt standard, this being a copy of the imperial standard of the German Government.

Queen & Co. were pioneers in this country in the construction of X-ray apparatus, and their outfits are to-day found in the principal laboratories and hospitals. During the war they had outfits and an operator at Fort McPherson, and achieved many interesting and valuable results in connection with the operations on the wounded brought to that place. Two large outfits were furnished to the United States Marine Hospital Service, one of which was used at Tampa, Fla., and a further war installation of theirs was the equipment of the U. S. A. hospital ship, Missouri, with an X-ray outfit.

To illustrate the thoroughness with which Queen & Co. have investigated the X-ray subject, we might add that since the first reports of its original discovery, experimental work has been going on unceasingly. One of the valuable results attained has been the production of an automatic X-ray tube, that constantly maintains its own vacuum at any point desired. Queen & Co. have received autograph letters from Prof. Röntgen and Lord Kelvin complimenting them on the production of this tube and the distinct advance which they have thus made in facilitating the application of the X-rays to the needs of the surgeon. Another feature of value is their vibrator, a device so simple, and yet so perfect, that it will break as satisfactorily on the 110 volt circuit as on the low voltage battery circuit. It is needless to say that its use has rendered useless the cumbersome motor break with its attendant complications and annoyances.

We have now to note the standardizing laboratory, where the high grade electrical work is standardized. This department, removed from the influence of external disturbance and mechanical vibrations, is completely under the control of the operator, permitting of accurate adjustment of the temperature, and enabling the humidity to be as satisfactorily controlled. Here are finally adjusted standards of resistance, standards of capacity, e. m. f., etc. The laboratory is equipped with all necessary apparatus and affords facilities securing the utmost precision in adjustment of the various industrial and scientific instruments. The laboratory standards are copies of the imperial standards of the German Government, and were adjusted for Queen & Co., to an unusual degree of accuracy.

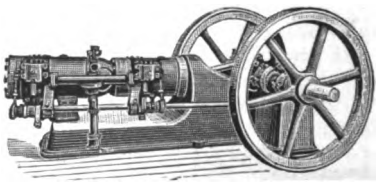
It would be interesting to follow in detail the operation of the other departments, but as this article is intended as a description of the electrical instruments, the other branches can receive but brief mention. It is interesting to note, however, that microscopes, including the objectives, are manufactured complete in this establishment, as well as telescopes up to five-inch aperture. Some idea of the accuracy of the work required on the lenses for microscope objectives may be formed from the statement that templates in glass for the accurate testing of objectives are ground and polished to the one 240-thousandth part of an inch, enabling an error of that magnitude to be determined in the objective. Of course these measurements are obtained by optical means, since the micrometers used will measure to only one one-thousandth of an inch. The grinding of these small lenses is done by holding the glass, which is cemented to a handle, against a matrix rotating on the spindle of a small lathe. Much skill is required for this work, though the tools are quite simple. An exceedingly delicate sense of touch, necessitating years to develop, is absolutely essential in a good workman. By this means a skilful operator can decide whether or not his surface is polishing correctly, even before it is examined optically. Glass of various optical qualities is imported in blocks and cut into proper dimension by revolving iron discs fed with emery or diamond dust, which embed themselves into the metal and offer suitable cutting surfaces. It is interesting to note that the manufacture of glass for optical purposes is a large industry, as yet only scientifically developed in Europe. Some of the glass now used in microscope objectives required over ten years of the most exacting research on the part of scientists before it was fitted for use.

The successful management of a manufacturing establishment of the magnitude and diversified interest of Queen & Co., demands ability and judgment of the highest order, and the requisite executive and administrative facilities are found in the president of the company, Mr. John G. Gray, who is the active manager.

As previously stated, the establishment issues extensive catalogues and circulars from every department. The aim in this is not simply to list their products, but to so describe the various instruments as to show their uses and limits, and enable an intelligent purchaser to choose that device most eminently suited to his purpose. Their publications are sent to interested parties upon request.

Hicks Improved Gas and Gasoline Engines.

THE Hicks Gas Engine Co., Detroit, Mich., have recently made some decided improvements on their well-known engines which have improved their efficiency considerably and have added to the advantages possessed by these engines over the steam engine for many classes of work. In these engines, shown below, designed to use either gas or gasoline, two cylinders are set in line to work alternately, their pistons being on one piston rod to which an effective impulse is imparted for every revolution of the crank, doubling the power of the engine while adding only the weight of one cylinder and piston (a very small percentage of the weight of the engine). By thus doubling the number of effective strokes of the piston, a perfectly steady motion is attained. The engine is so constructed that every out-stroke of the piston delivers power to the shaft so that the



60 H. P. HICKS GAS AND GASOLINE ENGINE.

engine is twice as powerful as one in which every other out-stroke, only, is a power stroke; and further, all the power of the piston tends to force the shaft on to the solid parts of its bearing, and thus relieves the cap entirely of wear. In fact, the cap might be entirely removed and the engine would run; consequently there will be no jumping or pounding of the shaft in any of the bearings. The valves admitting the compound to the cylinders are direct acting vertical poppet valves, and being always closed on their seats when combustion is going on, they remain perfectly clean and require no attention or occasional scraping. The governor regulates the engine to a nicety as with steam. The engine is so well balanced that it can be run at full speed without being fastened down to the floor or foundation.

The following advantages are claimed by the company over

Digitized by Google

other engines: Greater simplicity; fewer parts, and running with less noise; explosions being one-half as heavy for the same power, less jar and twice the durability is attained; one-half the weight and floor space required for engines of the same horse power of any other make; all valves are direct acting vertical poppet valves and require no cleaning; there can be no improper mixture of gas and air, thereby greater economy; one explosion to each revolution, light or heavy, as load on engine requires; perfect regularity of speed, equal to the best automatic steam engine,; uses gasoline direct from the tank without carburetter; can use manufactured gas, producers' gas, natural gas or gasoline; can be used in any place where power is wanted; self-adjusting in every way, consequently only care required is to oil once a day; having one explosion to every revolution, requires about one-half the size and weight of balance wheels used for other makes; change of temperature has no effect on the operation of the Hicks.

The engines are recommended for all work which up to the present time has been done by steam engines, and besides for many purposes where steam cannot be used. As they get an explosion with every turn of the crank, they give a perfectly steady motion, making them suitable for flouring mills, electric light plants, grain elevators, large and small machine shops, etc.

The company have issued an admirable catalogue describing these engines and will be pleased to mail it to any one on application.

Western Electric Tile Bolt and Lock.

THE Western Electric Company, New York and Chicago, have recently placed on the market a tile bolt and lock devised for use in fireproof buildings where the columns and girders are covered with tiling. It is a safe and simple method for fastening insulators, rosettes, or other electrical appliances to ceilings, columns, or walls. It cannot be pulled out when properly set and yet can be easily removed when desired.

This device consists of two pieces of metal with partially corrugated outside surfaces which when placed together form a shape similar to a cone. The opening in the upper end when the pieces of metal are put together is countersunk, allowing the bolt head to which the insulators or other devices are to be fastened to fit snugly between the two pieces of metal. These two pieces of metal together with the bolt are inserted in a hole in the tiling. A small concave washer slips over the bolt and a nut is then screwed up close to the ends of the small pieces of metal; as it is gradually tightened it draws the bolt head down into the space between the two pieces of metal until it makes them bind tightly to the sides of the hole, the end deepest in the hole binding tightest; this leaves the shank of the bolt free for attaching any device that may be desired.

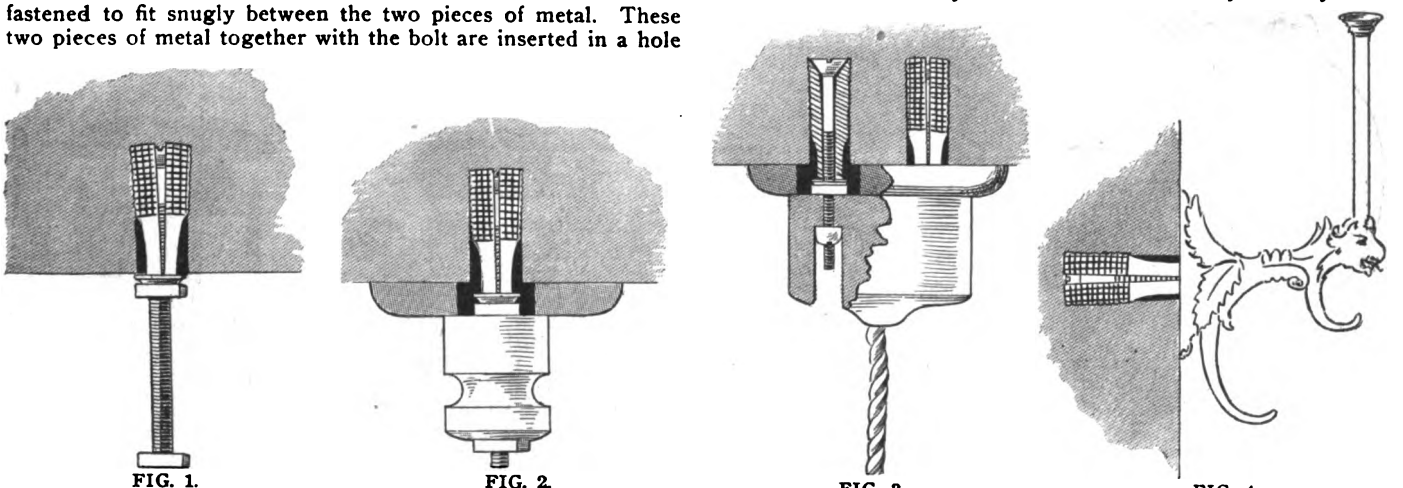


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

WESTERN ELECTRIC TILE BOLT AND LOCK.

Fig. 1 shows the screw or bolt attached to a ceiling while the illustrations next it, Figs. 2 and 3, show respectively an insulator and a ceiling button or rosette attached to the bolt. Fig. 4 shows how the tile bolt and lock may be used for attaching ornamental brackets to the side of a wall.

These tile bolts and locks are made in two sizes. One has a bolt 3½ by 3¼ inches, and includes the two conical pieces of metal which are called the lock; one small iron washer, two small iron nuts, and the bolt; the other has a bolt 2 by ⅛ inches, includes the lock, the bolt, one small iron washer, one small iron nut, and one brass nut, which is slotted so that a screw driver as well as a wrench may be used on it.

It will be particularly noted that partitions in the tiling or tile or marble slabs resting against flat surfaces do not interfere with the use of the tile bolt and lock as in the case of toggle bolts; with the tile bolt and lock there is no need of an open space as is required in the use of toggle bolts.

S. K. C. Transformers in Chicago.

The Western Electric Company, Chicago, appreciating the advantage to customers of prompt shipment of orders, carries in Chicago a complete stock of S. K. C. lighting transformers in sizes from 10 to 600 lights, which are supplied with or without fuse boxes as desired. The new style G, S. K. C. transformer is claimed to be the most efficient transformer on the market. The iron core is guaranteed not to age with use. Bulletin No. 11,001 will be sent to all interested upon application.

Western Electrical Supply Co.

The above progressive concern, of 10 and 12 North Ninth street, St. Louis, Mo., say: "We are pleased to advise that we have secured the general selling agency for the Warren Elect. Mfg. Co., manufacturers of the Warren alternator; also for the Maloney Electric Co., manufacturers of the Maloney transformers. In the Warren alternator we are able to offer to the trade an inductor type of machine that combines with a moderate price the very salient features of simplicity, durability, high efficiency and close regulation, and it has no revolving wires, brushes or commutator. We are prepared to furnish them in all sizes.

"In the Maloney transformers we are able to offer to the trade a transformer equal if not superior to any on the market, and we are able to offer it at a reasonable price, and back it up with strong guarantees. We can make prompt shipment from St. Louis. We will be pleased to furnish descriptive pamphlet and quote prices on application. In connection with the above we are now prepared to make shipments of the Adams-Bagnall alternating enclosed arc lamps, which are up to the usual high standard of the Adams-Bagnall arc lamps for other circuits.

"We shall have ready for distribution in a very few days our alternating current bulletin, containing cuts and full description of the above generators, transformers and arc lamps, and we shall be happy to mail same upon application."

South African General Electric Co.

Articles of incorporation have been filed with the Secretary of State by the South African General Electric Company, whose principal business office is to be in Schenectady. It is proposed to buy, sell and lease electric apparatus and machines and to construct works and plants involving their use. The capital stock of the company is placed at $50,000, divided into shares of $100 each, and the directors for the first year, all residents of Schenectady, are the following: S. D. Greene, Henry W. Darling, D. Mazenet, J. R. Lovejoy and M. F. Westover.

Digitized by Google

Jandus Continuous Globe Enclosed Arc Lamp.

THE Jandus Electric Company, Cleveland, Ohio, who have earned an enviable reputation on account of the high grade and efficient enclosed arc lamps which they have produced, have recently placed on the market another type possessing distinctively novel and advantageous features. They are a continuous globe surface below the arc, ready accessibility to the mechanism, rigidity of globe in the lowered position and enabling the trimmer to perform his work with the utmost rapidity. Fig. 1 shows the neat and compact external construction of the lamp. As there is no lower external globe support, the surface of the globe is made continuous, thus obviating any shadow and affording an attractive design.

The globe is lowered for trimming by a slight upward pressure with one hand and a turn to the left. This unlocks a special

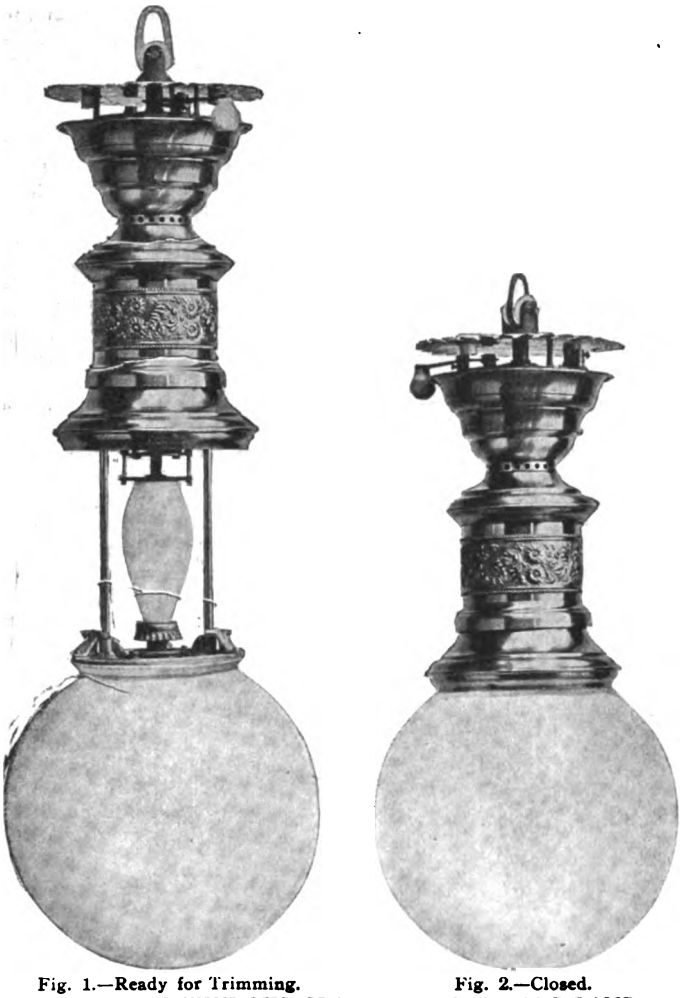


Fig. 1.—Ready for Trimming. Fig. 2.—Closed.
JANDUS CONTINUOUS GLOBE ENCLOSED ARC LAMP.

device and permits the globe to slide down to the position shown in Fig. 2.

The outer globe is securely fastened to a ring or collar which is maintained in a horizontal plane in any position and holds the globe in rigid relation to the lamp structure. No lamp heretofore designed has this important practical feature without embodying devices by which the globe is supported at its bottom. Thus, in trimming, the continuous globe is held rigidly while lowered—a feature which all lamp trimmers will appreciate. The inner globe and lower carbon can be quickly and easily removed for cleaning and retrimming.

To restore the outer globe to its normal position, it is simply raised or shoved upward with one hand. When at the proper point it turns by torsion of the side rods firmly into a locking device. Thus the lamp embodies one of the most rapid trimming devices ever offered in connection with enclosed arc lamps.

The case, by a slight turn, can be dropped to expose the working parts of the structure, which are of the regular Jandus "Twenty-five Inch" type. Patents on this lamp are now pending.

Lea Enclosed Arc Lamps.

STANDARD LEA ENCLOSED ARC LAMP BLACK FINISH.

THE Lea Manufacturing Company, Elwood, Indiana, have recently issued a catalogue giving full information about their enclosed arc lamps, which possess some very admirable and unique features. The company have aimed to keep the length of the lamp down to the smallest admissible to allow the use of full length carbons. The design is graceful and may be ornamented to any extent desired.

Lamps can be furnished for all circuits and for any voltage. They are all of the same general design and size, differing only in internal construction and proportions. The 110, 220 and 500 volt d. c. lamps all work singly on the circuit, thereby doing away with extra resistance, and well known troubles, occurring when enclosed lamps are used in series on constant potential circuits.

It is claimed that with clear globes about eighteen hundred candle power can be obtained, in contrast with one hundred and sixty candle power, from the same quantity of current, used in incandescent lamps. The attendance amounts to little more, as under ordinary use, once in two weeks is often enough for trimming. One pair of carbons burn from 125 to 160 hours, and as the stub, left from one trimming in the upper holder, serves as the lower carbon for the next trimming, about one dozen carbons will suffice for a year's run, burning five hours per day. All types of lamps, unless specially ornamented, are but twenty-one inches long over all, making them available even where extremely low ceilings are encountered.

The frame being made in one piece, getting out of alignment is entirely avoided, even with rough usage.

The carbon guides consist of two small brass rods extending

TRIMMING A LEA ENCLOSED ARC LAMP.

LEA ENCLOSED ARC LAMP. GLOBES AND COVER REMOVED.

from top of frame to inner globe cover, and as their only office is to loosely guide the upper carbon holder and carbon, no cleaning or polishing is necessary, no matter where the lamp is used.

The contact points, which generally are a fruitful source of trouble, is one of their strong features. Instead of requiring con-

Digitized by Google

stant cleaning and polishing, these contacts are always bright and always carry the current. Situated on top of the inner globe cover, and pressing on the carbon from opposite sides, are two brass fingers whose ends conform to the carbon and carry current to it. The carbon never presents the same surface twice, and there is no chance for dirt to accumulate, for the constant moving of the carbon keeps the brass points always bright and in good shape. Both upper and lower carbon holders are split to accommodate variations in the carbon, and as no screws are used it is an easy matter to slip carbons in place. A simple one-piece clutch is used on all but the alternating lamp. It is claimed not to stick nor to slip.

The upper cap of the small globe, being rigidly attached to the frame, remains stationary. The lower one is swiveled to the elevating screw, extending through an insulated bush in the lower part of the frame. Both are provided with asbestos washers. This construction allows the inner globe to be screwed tightly into place and does not depend on springs to keep it air tight. By lowering a screw the inner globe may be easily removed for cleaning.

The cover is made in two pieces and held in place by one small bolt. Being waterproof, no hood is needed for outside use. Loosening one screw allows the globe to be lowered for trimming or inspection, the chains supporting it below the lamp; this is clearly shown in the figure. As there are only two points of contact for the carbon, one in the inner globe cover, the other in the upper carbon holder, sticking is an impossibility, and no loose joints are required where the carbon enters the inner globe. To trim the lamp, it is only necessary to lower the globe, remove the cap from the lower extremity, and insert new carbons, leaving the inner globe in place.

The company are reporting increased sales of these lamps, which are meeting with universal satisfaction.

Ball Engines.

The House of Correction, Baltimore, Md., has recently started up a direct-connected plant. Fort Wayne Electric Corporation generators are direct-connected to two 60 h. p. engines which were built by the Ball Engine Co., Erie, Pa. The Garrett Building, Chicago, is to have an electric plant arranged according to the Arnold system. The Ball Engine Co., Erie, Pa., furnish one 250 h. p. and one 175 h. p. engine for the outfit. The Norfolk Navy Yard, Portsmouth, Va., are soon to have an addition to their plant, consisting of two tandem compound engines of 165 h. p. each, direct-connected to two 60 k. w. General Electric Co. generators. The Ball Engine Co. are contractors for the engines.

Abbott Elec. & Mfg Co.

The above company, which was recently incorporated, with headquarters at 74 Frankfort street, Cleveland, O., has organized with Mr. Wm. Marbach as president, Mr. C. B. Abbott as vice-president, Mr. A. D. Pettibone as secretary and treasurer, and Mr. Samuel Abbott as superintendent. The company will manufacture a line of specialties in the electrical field which will be duly noted from time to time. One of them will be ready by January 1 and is a cigar lighter that the Abbott-Marbach Co. started to put forward early this year. The new concern now has it down to a fine point, and considers the appliance to be perfection mechanically and electrically. Mr. Pettibone says: "We are putting it out in different styles of cases; one of the finest is a leather case looking very much like a "kodak" camera. The cost of all of them will be very moderate compared with any other lighter and we hope to get a large sale."

John Kammer Co.

A representative of The Electrical Engineer recently had the good fortune to be shown through the new incandescent lamp factory of the John Kammer Co., 176-178 Indiana street, Chicago. Their equipment is complete and modern throughout, and the conduct of the business is under the personal supervision of the president, Mr. John Kammer, who is a pioneer in the incandescent lamp business, having had eighteen years' experience, and having been for the past ten years a successful manufacturer. The "New Rival" lamp is produced under valuable and exclusive processes owned by Mr. Kammer, and is claimed to be the most highly efficient, economical and long-lived lamp on the market. Especial pride is taken by the company in the fact that their lamp is constructed especially to meet the several requirements of central stations, isolated plants and street railways, every lamp they turn out being particularly adapted to its class of work.

The John Kammer Co. absolutely guarantee their "New Rival" to be all they claim for it, and Mr. John Kammer's personal reputation would certainly warrant the belief that this guarantee will be lived up to to the letter.

We are also informed that this company are making a specialty of two, four and six candle power lamps for 50 and 100 volt circuits, and although just starting to market their product are having a good trade.

Moloney Transformers.

The Moloney transformer, for which the Western Electrical Supply Co., St. Louis, are general Western selling agents, seems to be meeting with very favorable results, judging from the large and constantly increasing business which that concern report in this line.

The Western Electrical Supply Co., we understand, carry a large and well assorted stock of these transformers in St. Louis, and will give their customers the benefit of prompt shipment. They will be pleased to furnish prices and data on application.

ADVERTISERS' HINTS

THE EDISON DECORATIVE & MINIATURE LAMP DEPT. of the General Electric Co. call attention to their stereopticon lamp. The filament is spiral in the form of an open watch spring and gives 50 c. p. at 50 to 120 volts.

HUEBEL & MANGER, 286 Graham street, Brooklyn, N. Y., advertise their iron box bell No. 189. They say it does good work because it is well made.

THE PENNSYLVANIA ELECTRIC CO., Marietta, Pa., state that they have been awarded the highest prize at the Omaha Exposition for superior telephone apparatus.

THE JOHN KAMMER COMPANY, 176-178 Indiana street, Chicago, announce that the "New Rival" incandescent lamps are now ready for shipment. Their specialties are 2, 4 and 6 c. p. lamps for 50 and 110 volt circuits and highly efficient central station lamps.

THE HICKS GAS ENGINE CO., 308 Atwater street, Detroit, Mich., advertise the Hicks compound gas engine adapted for electric lighting or for any work requiring steady power.

THE ELECTRIC APPLIANCE CO., 242 Madison street, Chicago, call attention to the "Jenkins" snap switch as "a snap in snap switches." They are made in a variety of sizes and the company claim great things for them.

THE C & C ELECTRIC CO., 143 Liberty street, New York, advertise the C & C motor for operating blowers and present an illustration of one in actual service.

THE AMERICAN PEGAMOID CO., 346 Broadway, New York, are introducing a decidedly novel wall paper which may be washed without injuring it. They will mail samples on request.

WESTERN NOTES

SHIP CARBONS IN THE WEST. The Electrical Engineer is in receipt of a neat pamphlet catalogue, a copy of which the Western Electrical Supply Co., of St. Louis are sending out to the trade, giving the latest market prices on the well known "Ship Carbons" manufactured by Schiff, Jordan & Co., Vienna and Nuernburg. The Western Electrical Supply Co. are, we understand, heavy dealers in both the "Ship" and "Electra" imported carbons, and carry at all times a well assorted stock in St. Louis, thus enabling them at all times to make promt shipments.

THE WESTERN ELECTRICAL SUPPLY CO., St. Louis, Mo., report very large sales for their well known "Monarch" incandescent lamp, which is so well and favorably known to the trade, and which, it is claimed, possesses merits making it the

Digitized by Google

equal, and in some respects the superior, to any other incandescent lamp on the market.

CRANE CO. Among the recent contracts for piping which the Crane Company of Chicago have closed may be mentioned the Arnold Electric Power Station Co. at Oelwin, Ia.; the Government Tramways, Sidney, New South Wales (Harris Street Station); and the Edison Illuminating Co., Detroit, Mich.

PRESIDENT SWINGLEY, of the Chicago Armature Co., is very happy over the good business his firm have been doing recently. Their motto is "quick repairs."

ST. LOUIS, MO. Negotiations are on foot for the sale of the Missouri Edison Electric Light and Power Company to an Eastern syndicate, of which H. B. Hollins & Co. of New York form the head. It is understood that an option on the plants, properties and franchises of the company has been given and that the Eastern financiers are now carrying the deal to consummation.

MR. J. R. WILEY, who represents the Standard Underground Cable Co., in Chicago, has been in New York for a short time, and now returns. He has enjoyed a fine trade in the West for some time past, but expects to beat all records. He reports the outlook as splendid.

NEW YORK NOTES.

THE ANCHOR ELECTRIC CO. have opened an office, for the greater convenience of their numerous patrons in New York City, in the Havemeyer Building, Cortlandt street, telephone number 3831 Cortlandt. Mr. H. G. Issertel, formerly of the Walker Company, is in charge of the office, and will be pleased to see all of his old friends at the office of the Anchor Electric Company. It is the purpose of the Anchor Electric Company to carry a small stock in New York for emergency orders, and to do everything needful for the convenience of their customers in New York City and vicinity.

MR. C. J. KINTNER, the well-known patent expert of this city, has just been through a very serious bout of typhoid fever, by which he has been confined to the Post Graduate Hospital for several weeks. His recovery is hailed with delight not only by his professional and personal friends but by the entire New York Athletic Club, of which he has long been one of the most active and distinguished members.

THE STORAGE BATTERY SUPPLY CO., of 239 East 27th street, New York, enjoy a unique business in the repairing, renting and recharging of storage batteries, and have a large trade among those who use batteries for cautery, galvanic, faradic and X-ray operations, in addition to those who use them for fan motors and electric lights. They have also made arrangements by which they will rent complete outfits for Christmas trees and table decorations.

ZIMDARS & HUNT, 127 Fifth avenue, New York, the manufacturers of the well-known Zimdars & Hunt high grade electric light and power specialties, report that they have never before been so busy as they are now. Their factory is running night and day with an increased force.

NEW ENGLAND NOTES

BELKNAP MOTOR CO., Portland, Me., have just received two orders from the Stanley Elec. Mfg. Co., Pittsfield, Mass., for two of their Chapman voltage regulators for 500 k. w. machines; one being for the Northern Elec. Co., of Philadelphia, and the other for the Pennsylvania Elec. Co., of the same city. They report very satisfactory orders from all parts of the country.

MUNSON BURMAH SLATE CO., Portland, Me., are very busy on orders for slate for all kinds of electrical purposes. One of their largest orders of late was for the panel boards for junction boxes installed in the Exchange Court Building, in New York City.

RUSSELL-TOMLINSON ELECTRIC CO., of Norwich, Conn., has filed its articles of incorporation. The capital stock is $20,000.

WINDSOR LOCKS, CONN. Henry C. Douglas and others have advertised their intention of applying to the new Legislature for a charter of another electric road running through Windsor Locks, East Granby, Poquenock, Rainbow, Spoonville, Bloomfield and Scotland. There is an old charter for the same object that has never been carried into effect.

BOSTON & MAINE RAILROAD CO. are erecting at Portsmouth, N. H., a building for their electric power station. The building is 118 feet wide and 64 feet long, divided into two rooms—one for the boilers and the other for the engines and electric generators. The side walls are of brick, the roof construction fireproof; the trusses are of steel, and they support steel beams for the purlins on which is to be placed a concrete roof. The contract for the steel work was given to the Berlin Iron Bridge Company, of East Berlin, Conn.

BOSTON, MASS. A franchise has been granted by the board of aldermen to the Mass. Telephone & Telegraph Co., which agrees to furnish unlimited service at $6 per month. Among those interested is Oakes Ames.

G. & P. ENGRAVING CO., 185 Franklin street, Boston, Mass., are doing a large business in name plates for electrical goods and machinery; also are brass founders, etc. They solicit correspondence and inquiry as to prices, etc., and are glad to send their souvenir paper weight to all their customers.

CONTENTS.

EDITORIALS:
Phenomenal Export Trade 614
Prof. Forbes on Long Distance Transmission of Power 614
High Fireproof Buildings 615
Naming a Specialty 615
Exterior Incandescent Lighting 615

ELECTRIC LIGHTING:
Festoons of Incandescents on Chicago Business Streets (illustr.) .. 605
Features of English Lighting and Power Station Practice (illustr.) .. 606
The Mechanical Plant of a Modern Commercial Building—III. (illustr.) ..... Wm. H. Bryan. 611

ELECTRIC TRANSPORTATION:
The Detroit, Ypsilanti & Ann Arbor Interurban Electric Railway (illustr.) 612

MISCELLANEOUS:
Radical Changes Necessary in Fire Extinction in New York City. Jean Wetmore, E. E. 616
Electrical and Engineering Work in the Navy During the War.... Lieut. W. D. Weaver. 617
Trade Marks on Electrical Apparatus ..... Francis Forbes. 618
Transportation of Exhibits to Paris 618

LETTERS TO THE EDITOR:
City Electric Lighting at Crawfordsville, Ind. ..... F. D. Abraham. 618

TELEPHONY AND TELEGRAPHY:
The Collection of the Telegram Stamp Tax.—Some Figures from the Cuba Submarine Telegraph Co. 619
Talked Over a 1,900-Mile Circuit 620

MECHANICAL:
Sturtevant Vertical Engines and Four-Pole Generators (illustr.) ... 620

ROENTGEN RAYS:
The Kolle Telescopic Fluoroscope (illustr.) ..... F. S. Kolle, M. D. 622

SOCIETY AND CLUB NOTES:
Line and Engineer Officers in the Navy.—New York Electrical Society 622
Sixth Annual Meeting of the Underwriters' National Electrical Association.—The Electrical Trades' Society of New York.—Connecticut Electric Lighting Association 623

NEWS AND NOTES:
Exports of Electrical Material from New York 623
Demand for American Electrical Goods in Brazil 624

OBITUARY:
James Brown 624

PERSONAL:
Sir William C. McDonald (illustr.) 624

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Dec. 6, 1898 .. 625

THE STOCK MARKET:
A "Boom" Without Boom Features 625

TRADE NOTES AND NOVELTIES:
High Grade Electrical Measuring and Testing Instruments, X-Ray Apparatus and Other Scientific Instruments as Made by Queen & Co., Inc., of Philadelphia (illustr.) 626
Hicks Improved Gas and Gasoline Engines (illustr.) 626
Western Electric Tile Bolt and Lock (illustr.).—S. K. C. Transformers in Chicago.—Western Electrical Supply Co.—South African General Electric Co. 629
Jandus Continuous Globe Enclosed Arc Lamp (illustr.).—Les Enclosed Arc Lamps (illustr.) 630
Ball Engines.—Abbott Elec. & Mfg. Co.—John Kammer Co.—Moloney Transformers.—Advertisers' Hints.—Western Notes 631
New York Notes.—Western Notes 632

Department News Items will be found in advertising pages.

Digitized by Google

LAKE SUBMARINE BOAT.—MUNICIPAL OWNERSHIP.—ELECTRICITY IN THE WAR.

Electrical Engineer.

A WEEKLY REVIEW OF THEORETICAL AND APPLIED ELECTRICITY.

(Copyright, 1898, by THE ELECTRICAL ENGINEER, 120 Liberty Street, New York.)

Vol XXVI. No 556 NEW YORK, DECEMBER 29, 1898. Price 10 Cents.

FIBRE. *Our name is a guarantee of High Quality, Reasonable Prices, Prompt Service and Polite Attention.*

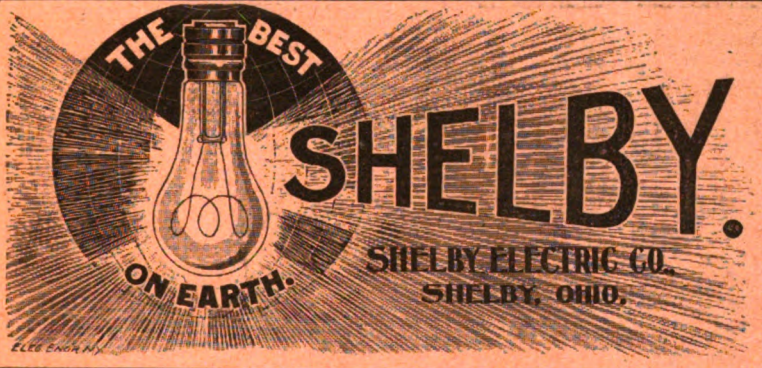
DELAWARE HARD FIBRE CO., Union and 10th Streets, WILMINGTON, DEL.

PARA-NITE INSULATED WIRES & CABLES *For Aerial, Submarine and Underground Use.* Telephone and Telegraph Cables a Specialty.

WHITE CORE LAMP CORD. PARANITE INSULATING TAPE. INDIANA RUBBER & INSULATED WIRE CO., Jonesboro, Ind.

"HARDY" Sustained Candle Power Their Strong Point. THE K. & W. CO., Pittsfield, Mass.

LAMPS. Manufacturers of Dynamo Brushes, Arc Hanger Boards, Spark Arresters and Commutator Compound. New York Office, 120 Liberty St. Western Representatives, Meysenberg & Badt, Chicago.



INCANDESCENT ..LAMPS.. ALL VOLTAGES. ALL CANDLE POWERS. ALL BASES. WRITE US FOR PRICES.

••• GRIMSHAW WHITE CORE WIRES •••

Raven White Core Wires, Raven Black Core Wires, Competition Line Wires, Grimshaw and Competition Tapes and Splicing Compound.

MANUFACTURED BY

NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 13-17 Cortlandt St., New York. BRANCHES: CHICAGO: 1320 Dearborn St. BOSTON: 134 Congress St. SAN FRANCISCO: 71 Flood Bldg.

SIMPLEX WIRES AND CABLES For Underground, Submarine, Line and Inside Construction. SIMPLEX ELECTRICAL CO. 75-81 Cornhill, Boston. 1137 Monadnock Block, Chicago.

C. O. Mailloux, CONSULTING ELECTRICAL ENGINEER 150 NASSAU STREET, NEW YORK.

William Marshall, Manufacturer of ELECTRICAL CONDENSERS, STANDARDS A SPECIALTY. 709 Lexington Avenue, New York.

Frederick Sargent. A. D. Lundy. SARGENT & LUNDY, ENGINEERS, 13 and 15 Monadnock Block. CHICAGO, ILL

INSULATED WIRES AND CABLES. ALL KINDS—ALL SIZES. WE LEAD ENCASE FOR ALL. CREFELD ELECTRICAL WORKS. BOSTON: 49 Federal St. | FACTORY: Saylesville, R. I. | CHICAGO: 239 Madison St.

PUSH FLUSH SWITCHES. ANCHOR ELECTRIC CO.

THE STANDARD For RUBBER INSULATION. Okonite Wires, Okonite Tape, Manson Tape. CANDEE WEATHERPROOF WIRES. THE OKONITE CO., Ltd., 253 Broadway. NEW YORK.

Every Electric Light and Railway Plant should be provided with BRISTOL'S RECORDING VOLT and AMMETERS Makes continuous record day and night. Send for circular. THE BRISTOL CO., WATERBURY, CONN. New York Branch. 121 Liberty St.

TRADE GONDA MARK. BATTERIES THE STANDARD OF THE WORLD. The Leclanche Battery Co. 111 to 117 E 131st St., New York

Pepper & Register, ELECTRIC STREET RAILWAY CONTRACTORS AND ENGINEERS. DAVID PEPPER, JR., M.E. A. L. REGISTER, M.E. 1414 So. Penn. Sq., Philadelphia, Pa.

MAGNET WIRES.

NATIONAL INDIA RUBBER CO. Rubber Covered

WIRES AND CABLES. Office and Factory, BRISTOL, R. I.

WHEELOCK BATTERY. Without an Equal for Fan and all Motors. Does not polarize under heavy work.

DRY BATTERIES Best of all is the "Mascot." Made by J. H. BUNNELL & CO., 76 Cortland St., N. Y. Best construction and ingredients. Strongest, most durable and reliable. Size 6x2½. 50 cents per cell. Liberal discount.

EXPERT CHEMISTS. SPECIALISTS IN ARMATURE AND FIELD COIL INSULATION. MASSACHUSETTS CHEMICAL CO., BOSTON, MASS.

IDEAL CIRCUIT BREAKER. E. A. La Roche & Co.,

RECEIVED, DEC 29 1898

Lawrence Scientific School Engineering Library.

Digitized by Google

INDIA & AMBER
MICA
IN ANY SHAPE OR PATTERN.

FOR ARMATURE COILS AND FIELDS.
EMPIRE INSULATED Cloths and Papers.
Eugene Munsell & Co.
218 Water St, New York

M·I·C· COMPOUND UNEQUALED.
Mica Insulator Co.
& Chicago. 117 Lake St

WRITE FOR SAMPLES AND PRICES.

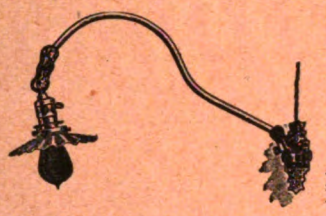
PERFECT
MICANITE
INSULATOR
REGISTERED

CARBON SPECIALTIES

Battery Cylinders, Telephone Transmitter Carbons,
Carbon Brushes and Electric Light Carbons.

SOLAR CARBON & MANUFACTURING CO.,
339 FIFTH AVENUE, PITTSBURGH, PA.

OSTERBERG & SUTTON.
Consulting Engineers and Electrical Experts,
POWER TRANSMISSION, LIGHTING and RAILWAY WORK.
Tele. 732 Broad.
MAX OSTERBERG, E. E. A. M.
FRANK SUTTON, E. E.
Bowling Green Bldg., 11 Broadway, N. Y.



THE O. C. WHITE COMPANY,
WORCESTER, MASS.
Adjustable Fixtures for Incandescent Lamps for Every Practical Requirement.
In many Styles, Sizes and Finishes.
For Shops, Factories, Offices, Libraries, etc.
SEND FOR OUR CATALOGUE K.

"VULCANIZED FIBRE."

Highest Grade for Electrical Insulation and Mechanical Purposes.

IN SHEETS, TUBES, RODS AND SPECIAL SHAPES.
CATALOGUE AND SAMPLES ON APPLICATION.
VULCANIZED FIBRE COMPANY, Wilmington, Del.

Write for Circulars . . .
QUEEN & CO.
1010 Chestnut St., PHILA PA.
N. Y. BRANCH, 59 Fifth Ave.

Davidson Steam Pumps.
Surface Jet and Evaporative **CONDENSERS.**
Vertical Air Pumps. Cooling Towers.
43-53 Keap Street, BROOKLYN,
133 Liberty Street, NEW YORK.
30 Oliver Street, BOSTON.

FORT WAYNE ELECTRIC CORPORATION.
Fort Wayne, Ind.
Apparatus for Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.

PAUL HOENACK,
Manufacturer of Electrical and Telegraph Instruments and Small Machinery. Experimental Work a specialty. Highest reference by permission. 191 and 193 Worth St., New York.
Established 1878.

American Vitrified Conduit Company,
MANUFACTURERS OF
Vitrified Salt Glazed Underground and Interior Conduits.
Contractors for Complete Installation of Conduit Systems....
C. J. FIELD, General Manager and Chief Engineer.
General Office: 39 Cortlandt St., New York.

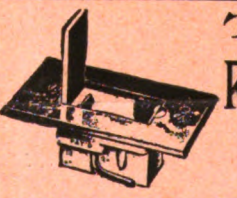
McINTIRE'S PATENT
CONNECTORS AND TERMINALS.
Special Connectors for Hard Drawn Copper Wire.
ALL SIZES. Fused Wire, Fused Links and Strips.
The C. McINTIRE CO., 13 & 15 Franklin St., Newark, N. J.

LAMP GUARDS.
GLOBE NETS.
WIRE GOODS.
WM. INGLIS
WIRE & IRON WORKS
DETROIT, MICH.

A. L. McRAE, CONSULTING ELECTRICAL ENGINEER.
Estimates, Plans, Specifications, Examinations, Reports, Tests.
306 Oriel Building. ST. LOUIS, MO.

DON'T BE MISLED into buying an imitation Worthington pump on the statement that it is practically the same as the original, only cheaper. Take time to examine the two and see the difference. Look at the valve motion: Worthington's—steel forgings; simple, mechanical design. Copy—cast iron, conglomerate designs. Water cylinders: Worthington's—composition lined. Copy—cast iron, and bored out and left to rust. General finish and appearance: Worthington's—good, carefully studied. Copy—sloppy, obsolete designs and rough. This is natural enough. Worthington has immense shops fitted with special machinery and charges enough to justify the use of the best of everything. Copy—small shops; cannot command trade enough to warrant expense of special tools, or prices enough to pay for extra care or finish. If you want the cheapest, buy copy. If the best, any one of experience will tell you to take the original.

HENRY R. WORTHINGTON,
NEW YORK.



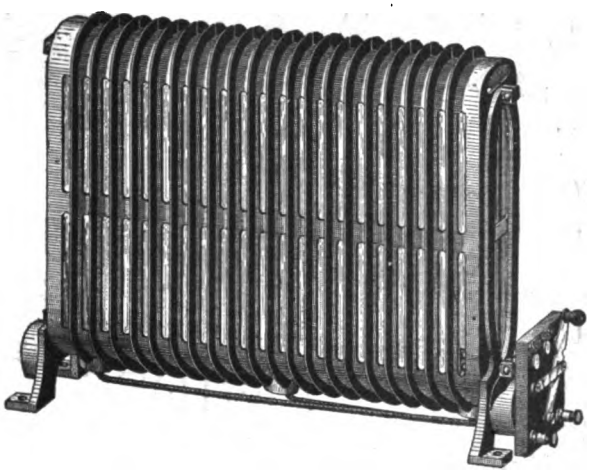
The Best...
Receptacle AND Attachment Plug
The latest in this line is the NEW STYLE made by
WM. T. PRINGLE, 1026 Filbert Street, PHILA.

PLATINUM WIRE OR SHEET FOR ALL USES.
SCRAP BOUGHT
C·F·CROSELMIRE
251 to 255 NEW JERSEY R.R. AVE.
NEWARK·N·J.

Press of THE CHEROUNY PRINTING AND PUBLISHING CO., 17-27 Vandewater St., New York.

Digitized by Google

The W. E. Electric Heater.



The ELECTRIC HEATER is extremely valuable in heating small offices, bath rooms, cold corners, street railway waiting rooms, and the summer villa. The heater is perfectly clean, does not vitiate the air, and is portable. It is finished in black enamel and japan.

Send for Special bulletin 9 E. H.

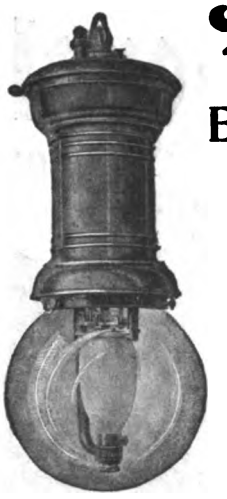
Western Electric Company,

CHICAGO. NEW YORK.

LONDON, 79 Coleman St. *ANTWERP, 23 Rue Bondewyns.* *PARIS, 45 Avenue de Breteuil.*

...The **Monarc**

TRADE MARK.



ENCLOSED ARC LAMP.

Is only 22 inches over all.

Burns 150 hours.

Has a new device which renders retrimming the easiest possible operation.

Every part can be easily inspected, removed and replaced if necessary.

Send for Circular.

Albert & J. M. Anderson Mfg. Co.,

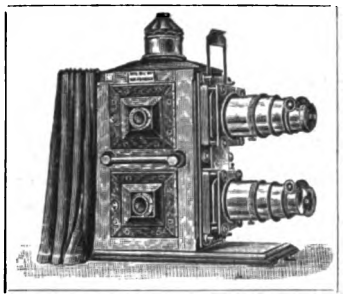
289-293 A Street, SO. BOSTON, MASS.

LEA ENCLOSED ARC LAMPS

SINGLE LAMPS FOR..... 500 / 220 / 110 VOLT CIRCUITS.

They have few parts, regulate perfectly, are graceful in design, and the price is right. Won't you let us tell you about them?

LEA MFG. CO.
ELWOOD, INDIANA.



WE ARE HEADQUARTERS FOR

Stereopticans, Magic Lanterns, Slides, Films, (American, English or French) and **All Accessories.**

Suitable for.... OIL, ELECTRIC or LIME LIGHT.

"NON-SUCH" ELECTRIC LAMP.

Back or Top Feed Light, Portable, Simple, Easily Manipulated. Best Lamp of its Kind on the Market.

RILEY'S NEW PATENT **KINEOPTOSCOPE**

Projects and depicts every movement of actual life on the screen.

Branches in United States: Boston, Chicago, Kansas City, Minneapolis, Chattanooga, Oakland; also Bradford, Eng., and Dunedin, New Zealand.

RILEY BROTHERS

16 Beekman Street, - - - NEW YORK.

SEND FOR OUR CATALOGUE AND PRICES.

TRADE MARK:

"Chloride Accumulator"

REGISTERED SEPTEMBER 11, 1894.

To Street Railway Managers:

If you are considering an increase in the capacity of your station, or an extension of your lines,

Investigate the Chloride Accumulator

and the results it is producing. Its use means a maximum efficiency of the power plant with a minimum investment in generating units and copper.

The Electric Storage Battery Co.,

DREXEL BUILDING, Phila., Pa.

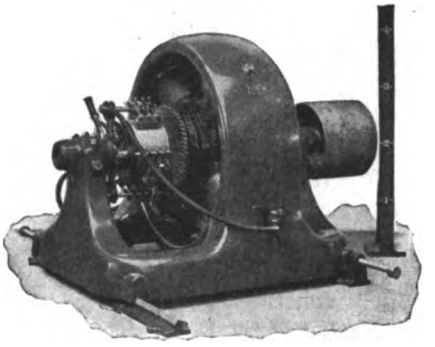
SALES OFFICES:

NEW YORK, 20-22 Broad St.
BOSTON, MASS., 60 State St.
BALTIMORE, MD., Equitable Bldg.
CLEVELAND, O., New England Bldg.
CHICAGO, ILL., Marquette Bldg.
SAN FRANCISCO, CAL., 20 Front St.
CANADA, The Canadian General Electric Co., Ltd., Toronto, Ont.

Digitized by Google

General Electric
COMPANY

SIMPLE
MOTORS



SATISFACTORY
MOTORS

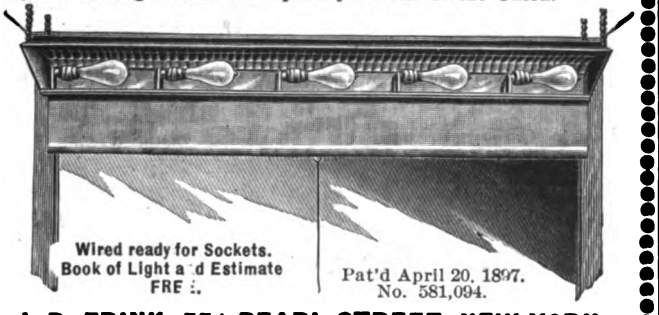
EVERY PART PERFECT
AND MADE TO GAUGE

General Electric
COMPANY

Sales Offices in all Large Cities. SCHENECTADY, N. Y. For Canada, address Canadian General Electric Co., Toronto, Ont.

Frink's Patent Special Window Reflector

Is placed in top of window near the front glass, reflecting a strong light inward and downward, and cutting off the direct light from the eye of the observer; the effect is truly astonishing. Adopted by the leading stores in the principal cities of the Union.

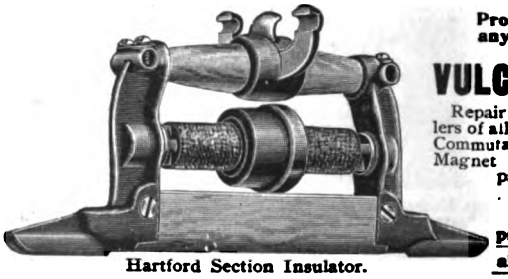


I. P. FRINK, 551 PEARL STREET, NEW YORK.
Telephone 860 Franklin. GEO. FRINK SPENCER, Manager.

Trolley Lino Matorials.

Moulded Mica Insulation.

STRONGEST. MOST DURABLE. BEST.



Hartford Section Insulator.

Prompt shipments in any quantity...

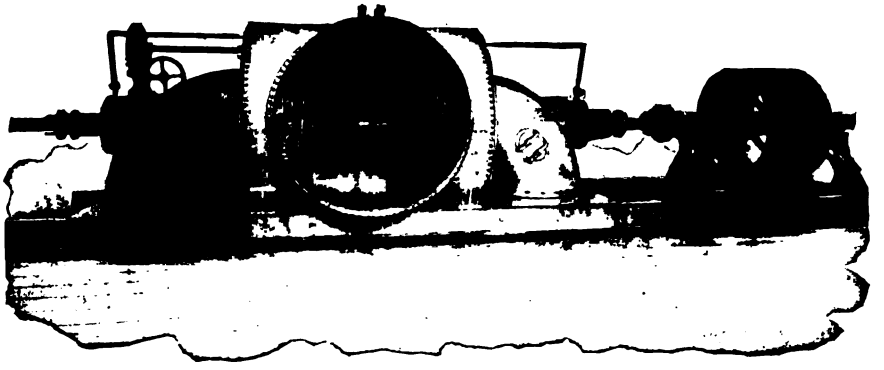
VULCABESTON.

Repair parts for car controllers of all the manufacturers. Commutator Rings, Bushings, Magnet Spools and special pieces for all purposes.

Note the revised prices in March Catalogue.

H. W JOHNS MFG. CO., 100 William Street, NEW YORK.
CHICAGO. PHILADELPHIA. BOSTON.

THE NEW AMERICAN TURBINE



...FOR...

Electric Power Transmission...

STATE YOUR REQUIREMENTS.

Send for Catalogue and mention The Electrical Engineer.

THE DAYTON GLOBE IRON WORKS CO., DAYTON, OHIO, U. S. A.

Digitized by Google

ALPHABETICAL INDEX TO ADVERTISEMENTS.

A—Allen Hussey Co. xxiv
American Battery Co. xix
Am. Bell Telephone Co.... xxv
Am. Elec. Tel. Co xxiv
American Electrical Works —
American Engine Co xvii
American Industrial Publishing Co .... —
Am. Impulse Wheel Co.... —
American Pegamoid Co ... —
American Reflector & Ltg. Co xvii
American Vitrified Conduit Co ii
Anchor Elec. Co i
Anderson, A. & J. M. iii
Armington & Sims Co..... xv

B—Bacon Air Lift Co xii
Baker & Co..... v
Ball Engine Co xv
Barnes, Wallace. xiv
Barnes Co., W. F. & J.. ... —
Beacon Lamp Co xvii
Beattie Zinc Works Co ... —
Becker, August xxxii
Berlin Iron Bridge Co xiii
Bernard Co., E. G.... xiv
Bibber-White Co.... i
Billings & Spencer Co . ... —
Bogart Co., A. L ..... —
Bossert Elec. Const. Co .. xii
Bristol Co i
Bryan & Humphrey. xix
Buckeye Electric Co. ... —
Bullock Mfg. Co., M. C. .. —
Bunnell & Co., J. H..... i

C—C. & C. Electric Co..... viii
Cabinet Mfg. & Supply Co.. xxiv
Cary Spring Co xviii
Cass & Aaron Co. x
Central Electric Co..... xiii
Central Mfg. Co v
Chicago Armature Co ..... —
Chicago Gen'l Fixture Co.. xvii
Chicago Ins. Wire Co ... —
Cleveland Armature Wks... xxii
Columbia Incan. Lamp Co. —
Commercial Electric Co ... xii
Cooper Co., C. & G..... —
Cosmo Electric Co..... .. —
Crane Co., The..... xxvi
Craighead Engineering Co. xxx
Crefeld Electrical Works... i
Crocker-Wheeler Elec. Co.. xi
Crofton Storage Bat. Co.... v
Croselmire, C. F ii
Crown Woven Wire Brush Co xxii
Crosby Steam Gage & Valve Co v
Crouse-Hinds Elec. Co .. xxxii
Cutler-Hammer Mfg. Co... vii
Cutter Elec. & Mfg. Co..... —

D—Davidson, M. T..... ii
Dayton Globe Iron Wks. Co. iv
Dearborn Drug & Chem Co. vii
Delaware Hard Fibre Co... i
De Veau & Co ..... —
Diehl Mfg. Co ..... —

E—Eastern Elec. Cable Co. xix
Eddy Elec. Mfg. Co xi
Edison Decorative and Miniature Lamp Dept... —
Edison, Jr., T. A..... —
Edwards & Co.... xvi
Electric Appliance Co xviii
Electric Arc Light Co..... xvi
Electrical Engineer Institute of Correspondence, The.... xxviii & xxix
Electric Gas Lighting Co.. —
Electric Railway Equip. Co. ii
Elec. Storage Battery Co... iii
Eller & Co., J. H..... ... —
Elliott Elec. Co., W. H..... —
Ellis & Co., B. O..... —
Elwell-Parker Elec. Co..... —
Emerson Elec. Mfg. Co.... xix
Empire China Works..... —
Eureka Elec. Co ..... —

F—Farquhar, A. B... ..... —
Farr Tele. Co xxiv
Ferracute Mach. Co xxxii
Ft. Wayne Elec. Corp ii
Forest City Elec. Co.. ..... —
Franklin Elec. Supply House..... .... —
Frink, I. P iv
Frontier Iron Works.... .. xvi
Fuel Economizer Co xxii

G—Garvin Machine Co.... xiii
G & P Engraving Co.. ..... —
General Electric Co.. iv
General Incandescent Arc Light Co .. .. —
Gold Street Car Heating Co xix
Goldmark & Wallace..... xxx
Goubert Mfg. Co xxvii
Grant & Co., J. A..... xv
Gregory Co., Chas. E xxi

H—Hammacher, Schlemmer & Co. xxxii
Hamblin, Geo. K... xxii
Hanchett, Geo. T. xix
Harris, F. B..... xxv
Hart & Hegeman Mfg. Co.. xxvii
Helios Elec. Co..... —
Hemingray Glass Co..... viii
Herrick, A. B.... xix
Heubach, D. A ..... —
Hicks Gas Engine Co. .... —
Hobert Elec. Mfg. Co. .. xiii
Hochhausen & Hall xxvii
Hoenack, P ii
Homer & Co., F. E. xxi
Horn & Brannen Mfg. Co.. xvii
Horry, Wm. Smith..... —
Horseless Age..... —
Huebel & Manger..... xxvi
Hunt Co., C. W..... xxvii

I—India Rubber & Gutta Percha Ins. Co..... viii
Indiana Rubber & Insulated Wire Co i
Inglis Wire & Iron Wks., Wm. ii
Institute of Correspondence, The Electrical Engineer. xxviii & xxix
Insulating Saddle Staple Co. —
International Correspondence Schools ..... —
Iron Clad Resistance Co .. xx

J—Jandus Elec. Co..... —
Jessop & Sons, Ltd., Wm . xxx
Jewell, E. W,..... .. xix
Johns Mfg. Co., H. W..... iv
Jones & Son, J..... vii

K—K. & W. Co i
Kammer Co., John xviii
Keystone Elec. Inst. Co.... xviii
Kieley & Mueller..... ... —
Klein & Son, M v
Knowles, C. S ..... —
Kokomo Tele. Mfg. Co... . xxv
Kuhlman Electric Co..... xix

L—Lancaster, L. H..... xv
La Roche & Co., F. A..... i
Lea Mfg. Co iii
Leclanche Battery Co..... i
Leffel & Co., The Jas..... xvi
Leonard Elec. Co., Ward .. xix
Liverpool & L & G. Ins. Co. —
Lombard Water Wheel Governor Co... . —
Lynn Incandesc. Lamp Co.. xxii

M—McIntire, The C. Co.. ii
McIntosh, Seymour & Co.. xv
McLennan & Co., K..... —
McLeod, Ward & Co..... xvii
McRae, A. L ii
Machado & Roller..... vii
Macmillan Co., The ..... —
Mailloux, C. O..... i
Manhattan Elec. Supply Co. xxv
Manross, F. N..... . .... —
Marshall, William i
Maryland Tele. Mfg. Co .... —
Mass. Chemical Co..... i
Mayer, G. M xviii
Meyrowitz, E. B..... xiv
Mianus Elec. Co xxii
Mica Ins. Co. ii
Michigan Pipe Co..... —
Miller Improved Gas Engine Co xxvi
Miller-Knoblock Co..... xxii
Moloney Electric Co..... xiv
Monarch Mfg. Co..... xxvii
Monarch Stove Mfg. Co..... —
Monson-Burmah Slate Co.. —
Montauk Multiphase Cable Co..... xiii
Montgomery & Co..... xxx
Munsell & Co..... ii

N—National Carbon Co.... —
National India Rubber Co. i
New York and Ohio Co..... vi
N. Y. Insulated Wire Co... i
N. Y. Patent Bureau..... —
N. Y. Telephone Co..... xxv
Nowotny Elec. Co ..... —

O—Ohio Elec. Specialty Mfg. Co..... —
Okonite Co ....i & xxxii
Osterberg & Sutton..... ii
Ostrander, W. R. & Co..... —

P—Paiste Co., H. T. .. xxii
Partrick, Carter & Wilkins. xxvii
Partridge Carbon Co. .... —
Pelton Engineering Co ... xxi
Pelton Water Wheel Co.... xxvi
Penna. Electric Co..... —
Penna. Railway Supply Co. —
Pepper & Register..... i
Peru Electric Mfg. Co..... xxii
Phelan, D. W..... xxv
Phillips & Sons, E v
Phillips Insulated Wire Co. xix
Phoenix Autom. Filter Co. xix
Phos. Bronze Smelting Co., Ltd xxvi
Potomac Terra Cotta Conduit Co..... xiv
Powers, E. L ... . —
Pratt & Whitney Co..... xiii
Prentiss Clock Imp. Co.... —
Pringle & Co., Wm. T..... ii

Q—Queen & Co ii
Quimby, W. E..... —

R—Raster Carbon Rheostat Co..... —
Reid, Thorburn xv
Reisinger, Hugo..... xviii
Ridgway Dynamo & Engine Co..... .. —
Riker Elec. Motor Co..... xxxii
Riley Bros iii
Roberts Elec. Supply Co., H C..... —
Roche, Wm..... —
Roebling's Sons Co., J. A.. —
Rosenbaum, Wm. A..... xix
Russell Elec. Mfg. Co..... —

S—Safety Third-Rail Electric Co., The..... ix
Samson Cordage Works xviii
Sargent & Lundy..... i
Sawyer-Man Elec. Co..... —
Schanda & Co., R..... —
Schiff, Jordan & Co ..... —
Sheaff & Jaastad xix
Shelby Electric Co..... i
Shultz Belting Co..... xxxii
Simplex Electrical Co..... i
Smith Co., S. Morgan..... —
Solar Carbon & Mfg. Co.... ii
Southwark Foundry and Machine Co..... xv
Sprague Elec Co. ..... —
Standard Paint Co..... xviii
Standard Ther. & Elec. Co... xvi
Standard Electric Time Co. xxx
Standard Underground Cable Co xix
Stanley & Patterson..... —
Stillwell-Bierce & Smith-Vaile Co. ..... —
Stone City Tel. Mfg. and Const. Co..... xxii
Storage Battery Supply Co. xix
Storey Motor & Tool Co.... —
Stromberg Carlson Tel. Co.. xxiv
Sturtevant Co., B. F..... xii

T—Thomas & Sons Co., B. xxvii
Thompson, Ed. P ..... —
Townsend & Decker..... xix

U—Uehling, Steinbart & Co. ..... —
United Elec. Improvement Co..... .... —

V—Varley Duplex Mag. Co. —
Viaduct Mfg. Co xxv
Victor Tele. Mfg. Co.. xxiv
Vitro Chrome Chemical Co. v
Vulcanized Fibre Co..... ii

W—Wagner Electric Mfg. Co..... —
Walker Co..... —
Warren Electric and Specialty Co..... xiv
Washburn & Moen Mfg. Co. xxvii
Webster Chem. Co. xiv
Webster & Co., Warren.... —
Wells, Heber..... xxxii
Western Electric Co..... iii
Western Elec Supply Co.. xxiii
Western Tel. Con. Co..... xxv
Westinghouse, Church, Kerr & Co..... xxx
Westinghouse Elec. & Mfg. Co..... ... xxxi
Westinghouse Mach. Co.... xxx
Weston Elec. Inst Co..... xxv
Wheeler Reflector Co..... xvii
White & Co., J. G..... xix
White Co., O. C..... ii
Williams Electric Co..... xxiv
Wolterreck, Herman C..... —
Worthington, Henry R ii
Wrought Iron Bridge Co... xxxii

Y—Yaryan Co., The..... xvi
Young Mfg. Co., W. C..... xxvi

Z—Zimdars & Hunt. .... —

"WANTED," "FOR SALE". and "BARGAINS" ....xx & xxi

FOR CLASSIFIED INDEX SEE NEXT PAGE.

Central Manufacturing Co.

Chattanooga, Tenn.
Manufacturers and Dealers in
YELLOW PINE CROSS ARMS, LOCUST PINS,
OAK PINS, ELECTRICAL MOULDINGS, OAK BRACKETS.
Large stocks on hand. Delivered prices quoted, F. O. B. cars, your city, in any quantity. Write us.

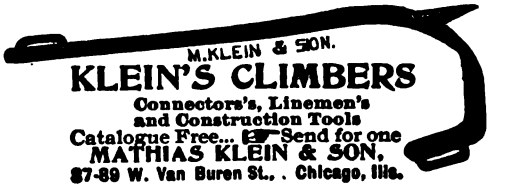
PURE ROLLED
ZINC PLATES
For Batteries and all Electrical and Mechanical Purposes. Special Shapes and Sizes Cut to Order
E. PHILLIPS & SONS, Manufacturers, SOUTH HANOVER, MASS.
Boston Office, 107 Summer Street.

CROFTON STORAGE BATTERY.
NOVEL FEATURES.
Cheap, Light, Durable, Efficient.
Motorcycle Batteries a Specialty.
CROFTON STORAGE BATTERY CO.,
JAMES K. PUMPELLY, MANAGER.
327 DEARBORN ST., CHICAGO, ILL.

CROSBY STEAM GAGE & VALVE CO.
SOLE MANUFACTURERS OF

Pop Safety Valves,
Water Relief Valves,
Improved Steam Gages,
Steam Engine Indicators,
Single Bell Chime Whistles,
Patent Gage Testers,
Pressure Recorders,
Revolution Counters,
Feed Water Regulators, and other Specialties.
Globe and Angle Valves, with renewable seats.
BRANDEN PUMP VALVES.
Rubber, with Wire Coil Insertion.
MAIN OFFICE AND WORKS: BOSTON, MASS.
Stores: Boston; New York; Chicago; London, Eng.

VITRO CHROME.
An indestructible Incandescent Lamp Color. Equal to natural glass in appearance and durability. Can be used for inside or outside decoration. Send for circular and prices.
VITRO CHROME CHEMICAL CO.
421 Milwaukee Street. MILWAUKEE, WIS.



M. KLEIN & SON.
KLEIN'S CLIMBERS
Connectors's, Linemen's and Construction Tools
Catalogue Free... Send for one
MATHIAS KLEIN & SON,
87-89 W. Van Buren St., Chicago, Ills.

In Sheet or Wire, any degree of Hardness,
FOR ALL PURPOSES.
PLATINUM
BAKER & CO., NEWARK, N. J.

Digitized by Google

CLASSIFIED INDEX TO ADVERTISEMENTS.

Annunciators.
Edwards & Co xvi
Electric Gas Ltg. Co ..... —
Partrick Carter & Wilkins.. xxvii

Arc Hanger Boards.
The K. & W. Co i

Arc Lamps.
A. & J. M. Anderson & Co,. iii
Diehl Mfg. Co ..... —
Electric Arc Light Co..... xvi
Ft. Wayne Elec. Corp ii
General Elec. Co..... iv
General Incan. Arc Light Co ..... —
Chas. E. Gregory Co..... xxi
Helios Elec. Co..... —
Jandus Elec. Co..... —
Lea Mfg. Co iii
Nowotny Elec. Co ..... —
Standard Thermometer & Electrical Co..... xvi

Armatures.
General Elec. Co..... iv

Asbestos Fabrics, etc.
H. W. Johns Mfg Co..... v

Batteries, Primary.
J. H Bunnell & Co..... i
Elec. Gas Lighting Co..... —
Elec. Storage Bat. Co..... iii
Leclanche Battery Co..... i
National Carbon Co ..... —
Partrick, Carter & Wilkins.. xxvii
Peru Elec. Mfg. Co..... xxii
Wm Roche..... —
Storage Battery Supply Co. xix

Batteries, Storage.
American Battery Co..... xix
Crofton Storage Bat. Co.... v
Elec. Storage Bat. Co..... iii
Storage Battery Supply Co. xix

Battery Gauges.
Standard Electric Time Co.. xxx

Bells.
Edwards & Co..... xvi
Huebel & Manger..... xxvi
W. R. Ostrander & Co..... —
Partrick, Carter & Wilkins. xxvii

Belt Dressing.
Shultz Belting Co..... xxxii

Boiler Compounds.
Dearborn Drug & Chem. Co. vii

Books.
Am. Industrial Pub. Co.... —
The Macmillan Co.... .... —
E. L. Powers ..... —

Bridges.
Berlin Iron Bridge Co..... xiii
Wrought Iron Bridge Co... xxxii

Brushes and Brush Copper.
Crown Woven Wire Brush Co v
General Elec. Co..... iv
Goldmark & Wallace (Koch). xxx
The K. & W Co i
Ohio Elec. Specialty Co ... —
Partridge Carbon Co..... —

Carbons.
General Electric Co..... iv
National Carbon Co..... —
Peru Elec. Mfg. Co xxii
Hugo Reisinger xviii
Schiff, Jordan & Co..... —
Solar Carbon & Mfg. Co... ii

Circuit Breakers.
Cutter Elec. & Mfg Co..... —
F. A. La Roche & Co..... i
Ward Leonard Elec. Co..... xix

Climbers.
Mathias Klein & Son..... v

Clocks.
Prentiss Clock Imp. Co.... —

Coal Conveyers.
G. W Hunt Co..... xxvii

Commutator Bars.
Forest City Elec. Co..... —
Chas. E. Gregory Co..... xxi

Commutator Compounds.
The K. & W. Co i
K. McLennan & Co..... —
Ohio Elec. Specialty Co.... —

Condensers, Electrical.
Wm. Marshall i

Conduits.
Am. Vitrified Conduit Co.. ii
N. Y. Ins. Wire Co..... i
Potomac Terra Cotta Conduit Co xiv

Connectors and Terminals.
The C. McIntire Co..... ... ii
Standard Underground Cable Co..... xix

Cut-Outs.
The E. G. Bernard Co..... xiv
Cutter Electrical & Mfg. Co ..... —
General Elec. Co..... iv
J. Jones & Son vii

Current Taps.
E. B. Meyrowitz..... xiv

Desk Lamps.
McLeod, Ward & Co..... xvii

Dynamos and Motors.
American Engine Co..... xvii
E. G. Bernard Co xiv
M. C. Bullock Mfg. Co..... —
C & C Electric Co viii
Commercial Electric Co. .. xii
Crocker-Wheeler Elecrical Co..... xi
Diehl Mfg. Co..... —
Eddy Elec. Mfg. Co.. xi
Emerson Elec. Mfg. Co..... xix
Ft. Wayne El. Corp ii
General Elec. Co..... iv
Chas E. Gregory Co xxi
Hobert Elec. Mfg. Co xiii
Pelton Engineering Co.... xxi
Ridgway Dynamo & Engine Co .... —
Riker Electric Motor Co... xxxii
Sprague Elec. Co ..... —
Storey Motor & Tool Co.... —
B. F. Sturtevant & Co..... xii
United Elec. Imp. Co..... —
Wagner Elec. Mfg. Co..... —
Western Electric Co..... iii
Westinghouse Elec. & Mfg. Co..... xxxi

Educational.
The Electrical Engineer
Institute of Correspondence.....xxviii & xxix
International Correspondence School..... —

Electric Heaters.
Gold Car Htg. Co..... xix

Electric Railways.
Safety Third-Rail Electric Co..... ix
Westinghouse Elec. & Mfg. Co..... xxxi
Willard Third-Rail El. Co. —

Electrical Contractors.
A. L. McRae..... ii
C. O. Mailloux..... i
Osterberg & Sutton..... ii
Pepper & Register..... i
Thorburn Reid xv
Sargent & Lundy i
Sheaff & Jaastad..... xix
J. G. White & Co..... xix

Electrical Engineers.
Bryan & Humphrey..... xix
Geo. T. Hanchett..... xix
Albert B. Herrick xix
Wm. Smith Horry..... —
L. H. Lancaster..... xv
Osterberg & Sutton..... ii
Edward P. Thompson..... —
J. G. White & Co..... xix

Electrical Specialties.
Electric Appliance Co xviii
Electric Gas Ltg. Co..... —
Ohio Elec. Specialty Mfg. Co..... —

Engineers.
Westinghouse, Church, Kerr & Co xxx
Westinghouse Mach. Co.. xxx

Engines, Gas.
Frontier Iron Works..... xvi
Mianus Elec. Co. xxii
Miller Improved Gas Engine Co.... xxvi
Westinghouse, Church, Kerr & Co xxx
Westinghouse Mach. Co.... xxx
Yargan Co..... xvi

Engines, Steam.
American Engine Co..... xvii
Armington & Sims Co..... xv
Ball Engine Co., Ttre xv
M. C. Bullock Mfg. Co..... —
C. & G. Cooper Co..... —
J. A. Grant & Co. xv
McIntosh, Seymour & Co.. xv
Ridgway Dynamo & Engine Co ..... —
Southwark Foundry & Mach. Co..... xv
B. F. Sturtevant Co..... xii
Westinghouse, Church, Kerr & Co..... xxx
Westinghouse Mach. Co ... xxx

Engine Stops.
Monarch Mfg. Co..... xxvii

Fan Motors.
C. & C. Electric Co..... viii
Crocker-Wheeler Elec. Co.. xi
Diehl Mfg. Co ..... —
Emerson Elec. Mfg. Co..... xix
General Elec. Co..... iv
K. & W. Co..... i
B. F. Sturtevant Co. xii
Wagner Elec. Mfg. Co..... —
Western Elec. Co.... iii
Westinghouse Elec. Mfg. Co. xxxi

Feed Water Heaters and Purifiers.
Goubert Mfg. Co..... xxvii

Fire-Proof Cements and Coatings.
H. W. Johns Mfg. Co..... iv

Fire-Proof Construction Materials.
H. W. Johns Mfg. Co.... .. iv

Fixtures.
Horn & Brannen Mfg. Co.. xvii

Fuel Economizers.
Fuel Economizer Co..... xxii

Fuse Links and Wires.
R. Schanda & Co..... —

Gas Lighting Apparatus.
Bibber-White Co. i
A. L. Bogart..... —
Electric Gas Lighting Co.. —

Hard Fibre.
Delaware Hard Fibre Co... i
Vulcanized Fibre Co..... ii

Ice-Making.
Westinghouse, Church, Kerr & Co xxx
Westinghouse Mach. Co..... xxx

Incandescent Lamps.
Beacon Lamp Co..... xvii
Buckeye Electric Co..... —
Edison Decorative and Miniature Lamp Dept.... —
T. A. Edison, Jr.,..... —
Electric Appliance Co..... xviii
Ft. Wayne El. Corp..... ii
General Elec. Co,..... iv
Geo. K. Hamblin..... xxii
K. & W. Company i
Lynn Incan. Lamp Co..... xxii
Machado & Roller..... vii
New York and Ohio Co.... vi
Sawyer-Man Electric Co.... —
Shelby Elec. Co..... i
United Electric Improvement Co ..... —
Warren Elec. Specialty Co. xvii
Westinghouse Elec. & Mfg. Co..... xxxi

Insulators and Insulating Materials.
A. & J. M. Anderson..... iii
Bibber-White Co,..... i
Delaware Hard Fibre Co... i
Empire China Works..... —
Hemingray Glass Co viii
Insulating Saddle Staple Co .... —
H. W. Johns Mfg. Co..... iv
John Kammer Co..... xviii
Ward Leonard Elec. Co..... xix
Mass. Chem. Co..... i
Mica Insulator Co..... ii
Eugene Munsell & Co..... ii
Peru Elec. Mfg. Co..... xxii
Standard Paint Co..... xviii
Stand. Undergr'd Cable Co. xix
Thomas & Sons Co., R..... xxvii
Vulcanized Fibre Co..... ii

Insurance.
Liverpool & L. & G. Ins. Co.. .... —

Iron Buildings.
Berlin Iron Bridge Co. xiii
Wrought Iron Bridge Co..... xxxii

Junction Boxes.
Bossert Elec. Const. Co..... xii
Ward Leonard Elec. Co..... xix

Lamp Adjusters.
O. C. White Co ii

Lamp-Coloring Compound.
Vitro Chrome Chemical Co. v
Webster Chemical Co..... viv

Lamp Guards.
Wm. Inglis Iron & Wire Wks. ii

Lightning Arresters.
A. & J. M. Anderson..... iii
Electric Appliance Co..... xviii
General Elec. Co..... iv

Lumber.
Central Mfg Co..... v
D. W. Phelan..... xxi

Machinery and Tools.
W. F. & John Barnes Co... —
Ferracute Machine Co..... xxxii
Garvin Machine Co..... xiii
Montgomery & Co xxx
Pratt & Whitney Co xiii
B. F. Sturtevant & Co..... xii
W. C. Young Mfg. Co..... xxvi

Magic Lanterns.
Riley Bros xiii

Mast Arms.
Berlin Iron Bridge Co. . xiii
Electric Railway Equip. Co. ii

Measuring Apparatus.
Bristol Co..... i
General Elec. Co..... iv
Chas E. Gregory..... xxv
Keystone Elec. Inst. Co .. xviii
Queen & Co..... ii
Weston Elecl. Inst. Co..... v

Mechanical Draft.
Westinghouse, Church, Kerr & Co..... xxx
Westinghouse Mach Co... xxx

Mechanical Stokers.
Westinghouse, Church Kerr & Co..... xxx
Westinghouse Mach. Co .. xxx

Mica.
Mica Insulator Co.... ii
Eugene Munsell & Co..... ii

Models.
Paul Hoenack..... ii
Geo. M. Mayer..... .. xvii

Motor Starters.
Cutler Hammer Mfg. Co..... vii
Zimdars & Hunt..... —

Name Plates.
August Becker xxxii
G & P Engraving Co..... —

Oil Filters.
Phoenix Autom. Filter Co. xix

Paints.
The American Pegamoid Co .... —
H. W. Johns Mfg. Co..... iv
Standard Paint Co... xviii

Patent Attorneys, Experts and Solicitors.
New York Patent Bureau.. —
Wm. A. Rosenbaum..... xix
Edward P. Thompson..... —
Townsend & Decker..... xix
Herman C. Woltereck..... —

Pattern Letters.
Heber Wells xxxii

Phosphor Bronze.
Phosphor Bronze Smelting Co., Ltd..... xxvi

Pipe Coverings.
H. W. Johns Mfg. Co..... iv

Platinum.
Baker & Co v
C. F. Crosselmire..... ii

Poles.
Berlin Iron Bridge Co..... xiii
D. W. Phelan xxv

Pumps.
Bacon Air Lift Co..... xii
M. T. Davidson..... ii
Wm. R. Quimby ii
Henry R. Worthington.... ii

Pyrometers.
Uehling Steinbart & Co.... —

Rail Bonds.
Jno. A. Roeblings Sons' Co. —
Washburn & Moen..... xxvii

Railroad Ties.
D. W. Phelan..... xxv

Railway Materials.
Creaghead Engg. Co..... xxx
Elec. Railway Equip. Co.... ii

Receptacles.
Wm. T. Pringle & Co..... ii

Reflectors.
Am. Reflector & Ltg. Co.... xvii
Chicago Gen'l Fixture Co.. xvii
I. P. Frink..... iv
Wheeler Reflector Co..... xvii

Refrigeration.
Westinghouse, Church, Kerr & Co..... xxx
Westinghouse Mach. Co.. xxx

Repairs.
Cass & Aaron Co..... xx
Chicago Armature Co..... —
Cleveland Armature Wks. xxii
W. H. Elliott Elec. Co..... —
Chas. E. Gregory..... xxi
Hochhausen & Hall..... xxvii
F. E. Homer & Co..... xxi
Miller-Knoblock Co..... xxii
Penna Ry. supply Co..... —

Rheostats.
Cutler-Hammer Mfg. Co... vii
General Elec. Co iv
Iron Clad Resistance Co... xx
Ward Leonard Elec. Co.... xix
Ohio Elec. Specialty Co. .. —
Raster Carbon Rheostat Co. —
Zimdars & Hunt..... ..... —

Roofing.
Berlin Iron Bridge Co xiii
H. W Johns Mfg. Co..... iv
Wrought Iron Bridge Co... xxxii

Slate.
Monson-Burmah Slate Co.. —

Sockets.
General Elec. Co..... iv

Spark Arresters.
The K. & W. Co..... i

Springs.
Wallace Barnes Co..... xiv
Cary Spring Co..... xviii
F. N. Manross..... —

Steam Loops.
Westinghouse, Church, Kerr & Co xxx
Westinghouse Mach. Co... xxx

Steam Packings.
H. W. Johns Mfg. Co..... iv

Steam Specialties.
Kieley & Mueller ..... —

Steam Turbines.
Westinghouse Church, Kerr & Co..... xxx
Westinghouse Mach. Co... xxx

Steel.
Wm. Jessope Sons Ltd..... xxx

Supplies, General Electrical
A. & J. M. Anderson..... iii
Bibber White Co..... i
J. H. Bunnell & Co..... i
Central Elec. Co..... xiii
Electric Appliance Co..... xviii
Franklin Electric Supply House..... —
General Elec. Co..... iv
Chas. E. Gregory Co..... xxi
J. Jones & Son..... vii
C S. Knowles..... xix
Nowotny Elec. Co..... —
H. T. Paiste Co. xxii
Partrick, Carter & Wilkins.. xxvii
Stanley & Patterson..... —
H. C. Roberts Electrical Supply Co..... —

SEE NEXT PAGE.

Packard Lamps and Transformers.

THE STANDARD OF NORTH AMERICA

RIGHT FOR PRICES.

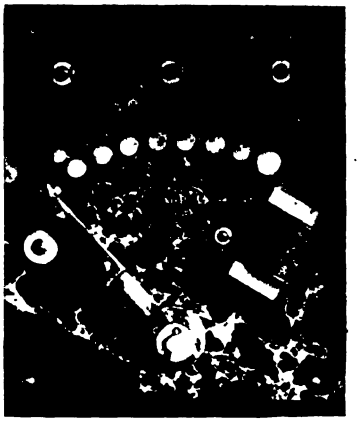
WRITE FOR PRICES.

New York & Ohio Company, ...

..Warren, Ohio.

Digitized by Google

DEARBORN VEGETABLE PREPARATIONS FOR BOILERS.



Patented.

DO YOU KNOW that there are more C. H. RHEOSTATS in use than of all other makes combined?

FIRE PROOF. *HANDSOME.* *RELIABLE.*

Approved by Fire Underwriters.

PROTECTS THE MOTOR from the results of an interrupted current.

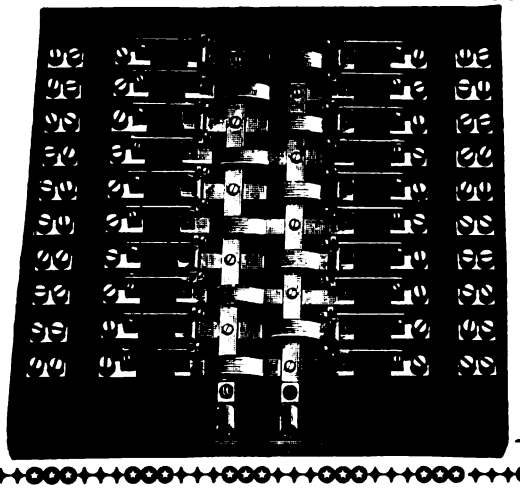
Motor Starting Boxes with Magnetic Release.
Overload Starting Boxes with Magnetic Release.

Automatic Starters for Pumps and Elevators.
Crane Controllers, Automatic Speed Regulators

The Cutler-Hammer Mfg. Co.,
70-82 W. Jackson Bvd., CHICAGO.

Largest Manufacturers of Rheostats in the World.

STURTEVANT ENGINEERING CO., 75 Queen Victoria St., E.C., London, Eng.; Agents for England and the Continent.



Panel Boards.

THE reason why our new departure in Panel Boards is meeting with such success is:

That they are fitted to all copper single brake switches; every piece of metal in the circuits is copper; Jones' patented Bus Bar connections are used throughout, making the most perfect contacts, thus reducing the resistance to a minimum and increasing the conductivity.

The strength and simplicity of design make them the most efficient and cheapest type of panel board yet manufactured.

All metal work is either dipped or of a highly polished finish and mounted on polished or marbleized slate.

Marble or onyx boards if desired at additional cost.

Our improved type of switch handle avoids all possibility of making contact with the fingers on the bus bars, and the consequent annoyance from shock.

Made in any combination, either for two-wire or three-wire mains, with two-wire or three-wire branches for any number of circuits.

If low prices combined with high quality count for anything we will secure your next order.

J. JONES & SON,

FACTORY BROOKLYN. 62 CORTLANDT ST., NEW YORK.

MACHADO & ROLLER

203 Broadway, New York.

A. E. G. INCANDESCENT LAMPS.

CLASSIFIED INDEX.—Continued.

Western Electric Co..... iii
Western Electric Supply Co. xxiii

Switchboards.
A. & J. M. Anderson..... iii
General Elec. Co..... iv

Switches.
Anchor Elec. Co..... i
A. & J. M. Anderson..... iii
Crouse-Hinds Elec. Co. xxxii
Cutter Elecl. & Mfg. Co.... —
General Elec. Co..... iv
Hart & Hegeman..... xxvii
Zimdars & Hunt..... —

Telegraph Apparatus.
J. H. Bunnell & Co..... i

Telephone Cabinets.
Cabinet Mfg. & Supply Co. xxiv

Telephones.
Allen Ramsey Co..... xxiv

Am. Bell Telephone Co.... xxv
Am. Elec. Teleph. Co..... xxiv
De Veau & Co..... —
Eureka Elec. Co..... —
Farr Tele. Co..... xxiv
E. W. Jewell..... xix
Kokomo Tel. Mfg. Co..... xxv
Manhattan Elec. Supply Co. xxv
Mianus Elec. Co..... xxii
N. Y. Telephone Co..... xxv
Penna. Elec. Co ..... —
Peru Elec Tel. Co..... xxii
Stanley & Patterson..... —
Stone City Telephone Mfg. & Const. Co xxii
Stromberg Carlson Tel. Co.. xxiv
Viaduct Mfg. Co..... xxv
Victor Tele. Mfg. Co..... xxiv
Western Elec. Supply Co... xxiii
Western Tel. Con. Co..... xxv
Williams Electric Co. xxiv

Transformers.
General Elec. Co..... iv
Chas. E. Gregory Co..... xxi
Kuhlman Elec. Co..... xix
Moloney Electric Co..... xiv
Wagner Elec. Mfg. Co..... —
Western Elec. Co..... ii

Trolley Cord.
Samson Cordage Wks.. ... xviii

Trolleys.
A. & J. M. Anderson..... iii

Valves.
The Crane Co..... xxvi
Crosby Steam Gage and Valve Co v

Water Motors.
Am. Impulse Wheel Co .... —

Water Wheel Governors.
Lombard Water Wheel Governor Co..... —

Water Wheels.
American Impulse Wheel Co. of N. Y..... xviii
Dayton Globe Iron Wks. Co. iv
The Jas. Leffel & Co . xvi
Pelton Water Wheel Co.... xxvi
S. Morgan Smith Co..... —
Stillwell-Bierce & Smith-Vaile Co..... —

Wires and Cables.
American Electrical Works. —
Crefeld Elecl. Works..... i
Eastern Elec. Cable Co..... xix
Electric Appliance Co..... xviii
General Elec. Co..... iv
Hammacher, Schlemmer Co..... xxxii
F. R. Harris..... —
India Rubber and Gutta Percha Ins. Co..... viii

Indiana Rubber & Insulated Wire Co..... i
Montauk Multiphase Cable Co... xiii
Nat'l India Rubber Co..... i
N. Y. Insulated Wire Co.. i
Okonite Co., Ltd., The ...i & xxxii
Phillips Insulated Wire Co xix
Jno. A. Roebling's Sons Co. —
Simplex Elecl. Co..... i
Stand. Underg'd Cable Co.. xix
Washburn & Moen Mfg. Co xxvii

Year Books.
D. A. Heubsch..... —

Zinc.
Beattie Zinc Wks. Co..... —
J. H. Bunnell & Co..... i
E. Phillips & Sons..... v

Digitized by Google

ASTORIA ❧ DELMONICO'S ❧ SHERRY'S

Habirshaw

WIRES & CABLES

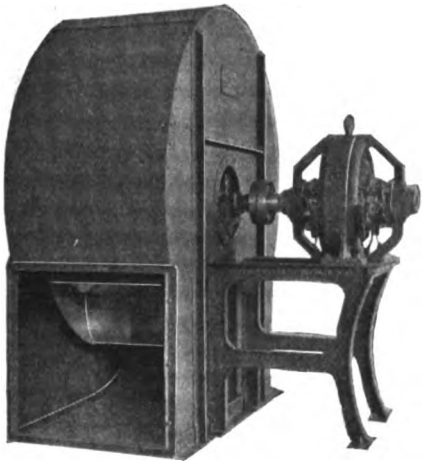
USED THROUGHOUT THIS BUILDING.

The India Rubber and Gutta Percha Insulating Co.,

Main Office, Glenwood Works,

YONKERS, N. Y.

J. W. GODFREY, Manager Sales,
15 Cortlandt St., NEW YORK.



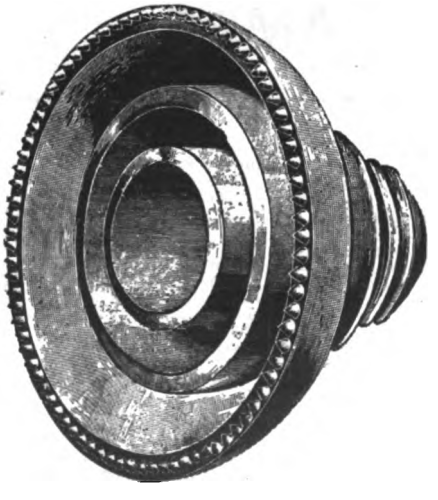
More Valuable Electric Current Is Wasted

in operating Blowers and Exhaust Fans, than in any other way we know of, for it is the practice of most motor makers to connect therewith motors of the ordinary type, in which speed reduction is secured through interposition of wasteful resistance in the armature circuit. *We* Don't Do It This Way. *Our* method is to get the reduced speeds through Field Control, Field Commutation, or Double Armature Windings, which method is an *Immense Current Saver.* If you are interested, write us for further information.

The C & C Electric Company,

Offices or Agents in leading cities.

Main Offices, 143 LIBERTY ST., NEW YORK.



FOR HIGH POTENTIAL POWER TRANSMISSION USE "PROVO TYPE" HIGH POTENTIAL INSULATOR.

This Insulator was designed by V. G. Converse, E.E., for the Telluride Power Transmission Company of Provo, Utah. It has been in successful operation for more than a year at Mercur, Colorado, carrying a current of 40,000 volts.

Manufactured and Guaranteed by

HEMINGRAY GLASS CO.

COVINGTON, KY.

Manufacturers of Glass Insulators for all purposes.

5¾ inches high; 7 inches wide.

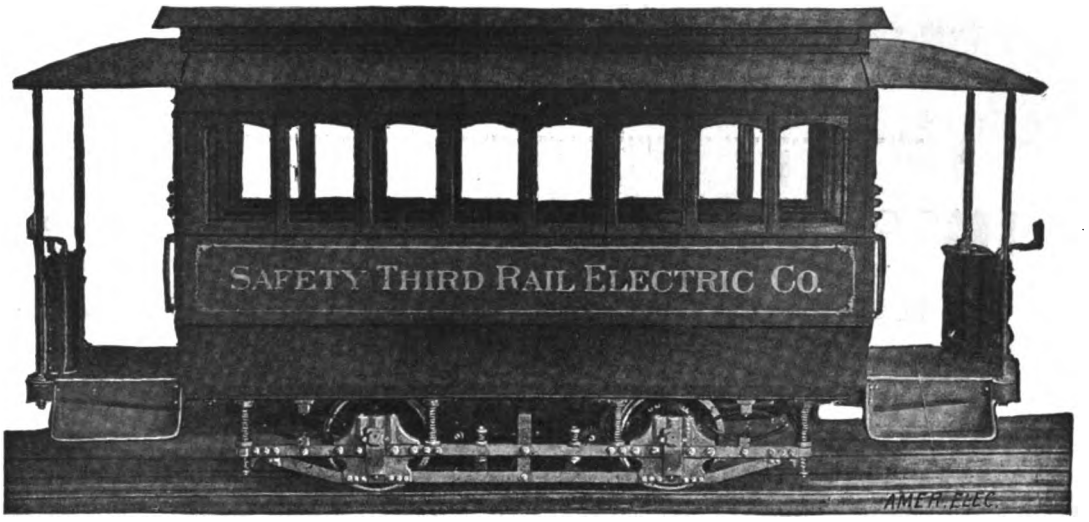
Digitized by Google

WE INVITE YOU

To Inspect and Investigate our

SECTIONAL CONDUCTOR SYSTEM

It is the only Third-Rail System adapted alike for surface and elevated roads, both for city and interurban traffic.



IT HAS THESE

SUPERIOR ADVANTAGES

Can be built for the price of a good overhead system.
Uses but a single set of third rails.
Does away with contact skates.
Is able to pick up its switc es without the power-house current.
Storage battery consists of but a few cells, which are continuously charged and require no attention.
The car lamps are always lighted, whether the power-house current is on or not.
The switches open by gravity, rendering the live section in the roadway possible only under the car.
The car body covers and guards both live sections, so that there is no danger to passing people or animals.
The switches are absolutely non-arcing.
The cars can be operated on a flooded track without danger or inconvenience.
The switches are extremely simple and absolutely reliable.

There are a great many other advantages which we will be very much pleased to experimentally demonstrate. A perfect working model of our Third-Rail System is in operation at our office. Bring with you the most competent disinterested electrical expert. Fullest investigation solicited.

Rooms 223-4-5-6-7
Temple Court Building

THE SAFETY THIRD-RAIL ELECTRIC CO.

NEW YORK

Digitized by Google

NEW YEAR ISSUE AND EXPORT NUMBER

The Electrical Engineer

DATED JANUARY 5th, 1899

WE CONFIDENTLY RECOMMEND this extraordinary number to our advertisers, as an issue in which it will pay them well to be represented by some striking and novel announcements, preferably on pages or even larger spaces.

This issue, in addition to covering **absolutely** all of the United States, Canada and Mexico, will be given a large **export** circulation, going to all the foreign countries in which there is electrical enterprise.

Electrical machinery exports for the months of September and October, 1898, amounted to $499,731, being more than double what they were in those months of 1897. This does not include electrical supplies.

This is an argument in itself for large advertising in this issue, and **Every Electrical Manufacturer** in this country can get a share of this business if they try.

Besides, the new construction in every electrical line in 1899 is going to be enormous.

A strong plea for business in this issue will assist you greatly, and will also, owing to our immense circulation of **20,000 COPIES,** be of extreme value as an inducement for business in this country.

Do not, therefore, delay until too late, but kindly let us hear from you as early as possible, as it looks now as if we would have to close our forms December 30 so as to get out this valuable number on time.

OUR REGULAR RATES WILL APPLY

THE ELECTRICAL ENGINEER
120 LIBERTY STREET
NEW YORK

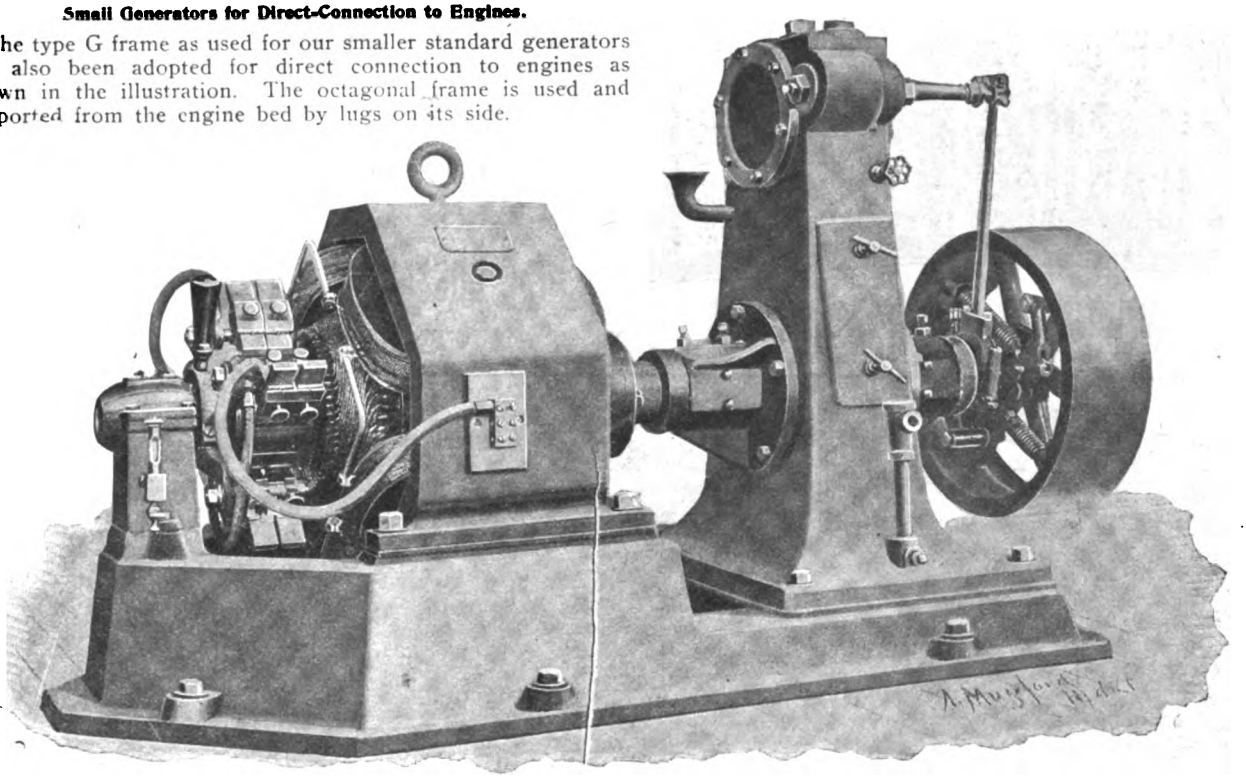
Digitized by Google

EDDY DIRECT CONNECTED GENERATOR.

TYPE G. D. C.

Small Generators for Direct-Connection to Engines.

The type G frame as used for our smaller standard generators has also been adopted for direct connection to engines as shown in the illustration. The octagonal frame is used and supported from the engine bed by lugs on its side.



THE EDDY ELECTRIC MFG. CO., WINDSOR, CONN.

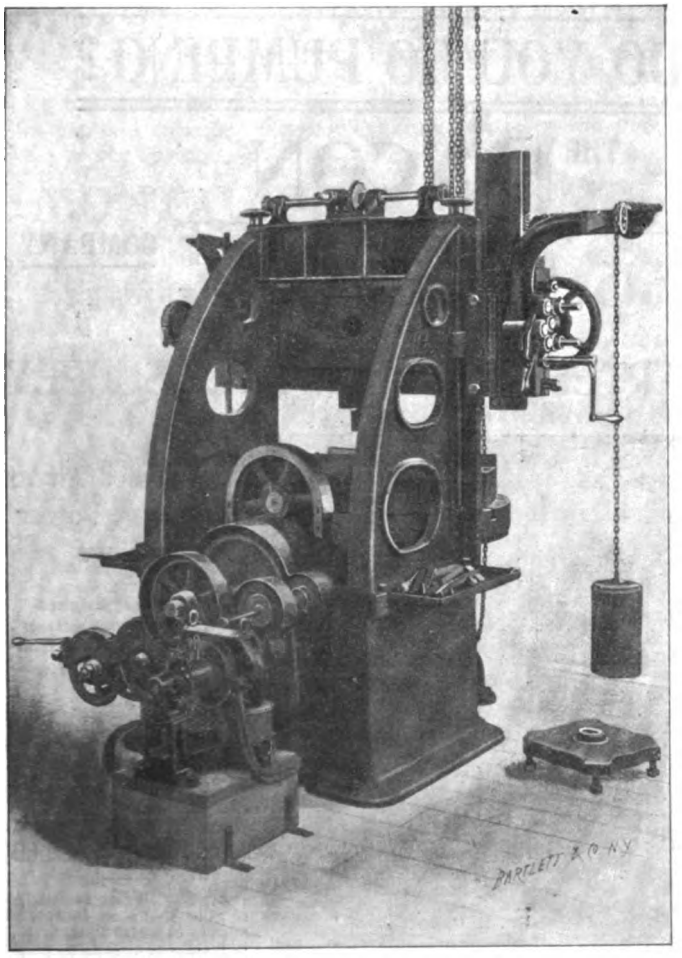


Fig. 241, from Photo. 109.
Size 2 Motor Geared to Vertical Boring Mill. Speed Changes by Nest of Gears.
Crocker-Wheeler Electric Company.

CROCKER-WHEELER ELECTRIC CO.

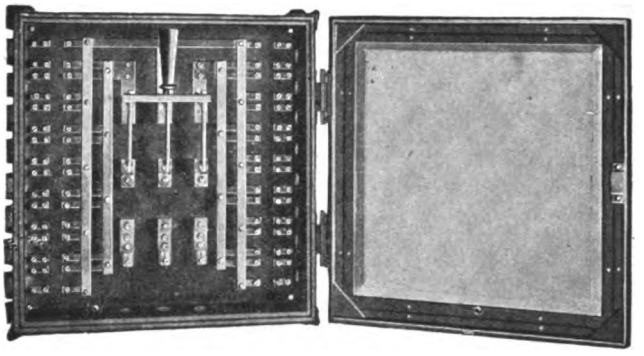
39 Cortlandt Street, NEW YORK — **Works: AMPERE, NEW JERSEY**

Dynamos and Motors for Factory Power Transmission

NEW YORK: Crocker-Wheeler Electric Co.
Main Office: *39 Cortlandt Street.*
NEWYORK: BLACKALL & BALDWIN, *39 Cortlandt Street.*
BRIDGEPORT, CT.: CROCKER ELECTRIC CO., *50 Middle Street.*
MINNEAPOLIS: W. I. GRAY & CO., *Sykes Block, No. 802.*
TOLEDO, OHIO: F. BISSELL & CO., *116 St. Clair Street.*
BUFALO: J. L. ALBERGER & SON, *695 Ellicott Square.*
PARIS, FRANCE: JACQUES ULLMANN, *16 Boulevard St. Denis.*
BALTIMORE, MD.: MCCAY ENGINEERING CO., *106 E. German Street.*
SOUTH AMERICA: DE REES-BUSH CO., *Care G. W. Sheldon & Co., 12 Broadway, New York.*
CHICAGO: Crocker-Wheeler Electric Co. *1515 Old Colony Building.*
LONDON, ENGLAND: GENERAL ELEC. CO., LTD., *71 Queen Victoria Street, E. C.*
MILWAUKEE: ROHN & MEYER, *448 E. Water Street.*
DETROIT, MICH.: AMERICAN ELECTRIC CO., *254 Randolph Street.*
GRAND RAPIDS, MICH.: GRAND RAPIDS ELECTRIC COMPANY.
WILMINGTON, DEL.: MORRIS & CO., *11 East Eighth Street.*
CLEVELAND: CLEVELAND ELEC. MFG. CO., *46 Sheriff Street.*
OMAHA, NEB.: WESTERN ELECTRICAL CO., *1510 Howard Street.*
PHILADELPHIA: Crocker-Wheeler Electric Co. *14 South Broad Street.*
BOSTON: BIBBER WHITE COMPANY, *40 Federal Street.*
SAN FRANCISCO: ABNER DOBLE CO., *Fremont and Howard Streets.*
CHARLOTTE, N. C.: ELEC. ENG. AND SUPPLY CO., *Hunt Building.*
ST. PETERSBURG, RUSSIA.: Compagnie to Traction et d' Electricité, Wassili Ostrow, 3 Ligne, 4.
YOKOHAMA, JAPAN: BAGNALL & HILLES.
COLUMBUS, OHIO: J. A. ERNER & CO., *354 N. High Street.*
NEW ORLEANS: NEW ORLEANS ELECTRIC CO., *726 Gravier Street.*

Digitized by Google

FIREPROOF. ECONOMICAL. INDESTRUCTIBLE.



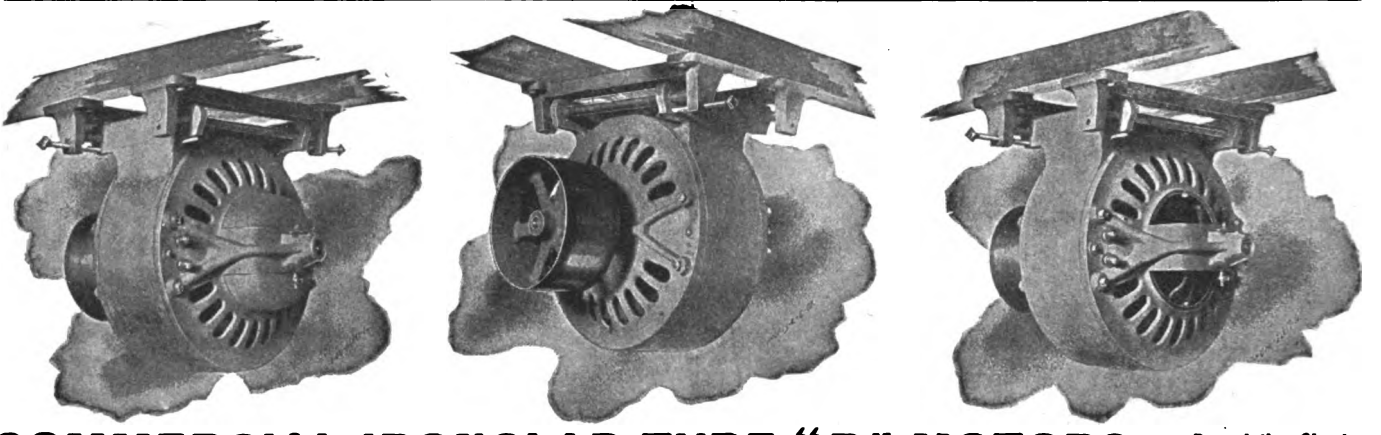
R. B. CORBY, Metropolitan Representative, Havemeyer Building, New York.

STEEL DISTRIBUTION AND MAIN JUNCTION OUTLET SWITCH AND CUTOUT BOXES

Sole Manufacturers and Patentees

The BOSSERT ELECTRIC CONSTRUCTION CO.,

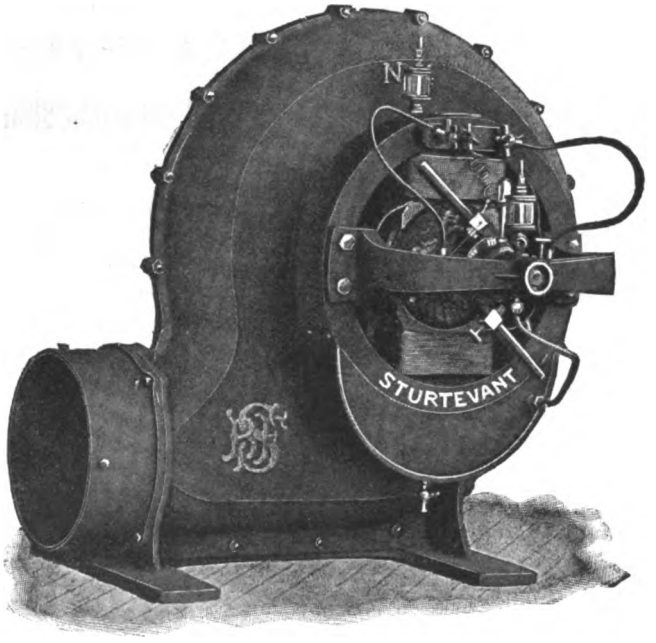
UTICA, N. Y.



COMMERCIAL IRONCLAD TYPE "R" MOTORS. Descriptive Circular No. 14 F.

COMMERCIAL ELECTRIC CO., 192 West Merrill Street, INDIANAPOLIS, IND.

THE STURTEVANT ELECTRIC FANS



All SIZES and STYLES for both LOW and HIGH PRESSURE WORK.
Send for Catalogues.

B. F. STURTEVANT CO., BOSTON, MASS., U. S. A.

WAREROOMS:

Boston, 34 Oliver St. New York, 131 Liberty St. Philadelphia, 135 No. Third St.
Chicago, 16 So. Canal St. London, Eng., 75 Queen Victoria St.

DO YOU DO PUMPING?

THE BACON AIR LIFT COMPANY

100 BROADWAY, NEW YORK

MAKES A SPECIALTY OF

ARTESIAN WELL WATER SUPPLY

Utilizing Compressed Air as the Motive Power for Pumping.

Well Systems Designed and Located for Electric Light and Power Stations Cities, Towns, Factories, Etc.

Suitable Pumping Machinery furnished and Erected

and put in actual operation with results GUARANTEED

Air Lift Plants remodeled so as to obtain an **increased supply of water** and a saving in fuel.

More than 250 wells satisfactorily operated by the Bacon system.

Digitized by Google

We want Buyers

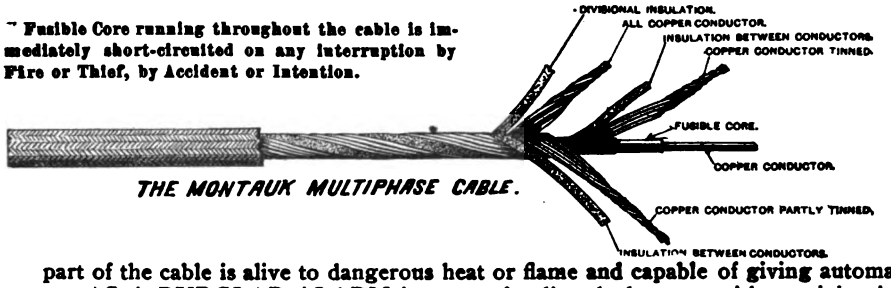
of Electrical Material to have our NEW CATALOGUE. It's concise; it's complete; it's a convenient catalogue to order by and we are a convenient house to order from, as we are central, we have the goods and we ship quick. We shall be pleased to send this catalogue to any one engaged in the Electrical Business. Send card or letterhead for a copy.

GEO. A. McKINLOCK, PRESIDENT.
CHARLES E. BROWN, SECRETARY.
S. R. FRAZIER, TREASURER.

Central Electric Company.
264-266-268-270 Fifth Avenue, Chicago.

What Montauk Multiphase Cable Is.

Fusible Core running throughout the cable is immediately short-circuited on any interruption by Fire or Thief, by Accident or Intention.



THE MONTAUK MULTIPHASE CABLE.

It is a cable constructed for use in place of plain wire for all interior electric adaptations, such as bells, telephones, district service, fire and burglar alarm, etc.

MONTAUK MULTIPHASE CABLE is superior to and differs from ordinary wire now in use, inasmuch as every infinitesimal part of the cable is alive to dangerous heat or flame and capable of giving automatic warning to any point desired.

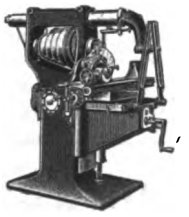
AS A BURGLAR ALARM it cannot be disturbed or cut without giving instantaneous warning.

IT IS THE ONLY FIRE-DETECTIVE CABLE IN THE WORLD. Recently adopted by the Gamewell Auxiliary Fire Alarm Company.

Every infinitesimal part is a thermostat and a watchman. Montauk Multiphase Cable never sleeps, never fails. Montauk Multiphase Cables are small, neat, and very flexible, and are perfectly insulated. They are furnished in "Damp-Proof" or "Water-Proof" construction and of any desired color, reeled or coiled in any length wanted. Their conductors are all standardized to equal carrying capacity. Samples and descriptive matter mailed on application. Workings of cable demonstrated at our office.

MONTAUK MULTIPHASE CABLE CO., 100 BROADWAY, NEW YORK.
Telephone, 4031 Cortlandt.

Metal Working Machine Tools



Fully Described in our New Illustrated Catalog, Just Issued.

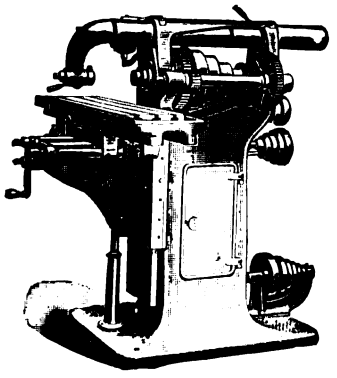
OVER 700 IRON WORKING TOOLS IN OUR STORE
READY FOR DELIVERY

COMPLETE PLANTS EQUIPPED FOR THE MANUFACTURE OF ELECTRICAL GOODS

PHILADELPHIA STORE, The Garvin Machine Co. 51 No. Seventh St. Philadelphia, Pa.

The Garvin Machine Co.
SPRING and VARICK STS., NEW YORK

BERLIN STORE, The Garvin Machine Co., m.b.H. 17 Berg Strasse, Berlin C., Germany.



TOOL ROOM EQUIPMENTS

AND PLANTS FOR MANUFACTURING

TYPEWRITING MACHINES, SEWING MACHINES,

and similar articles on the interchangeable system are furnished by the undersigned, of the highest quality, greatest efficiency and most satisfactory results to the buyer.

Ask for Catalogue B.

THE PRATT & WHITNEY CO.,
HARTFORD, CONN., U. S. A.
NEW YORK, 128 Liberty Street. BOSTON, 144 Pearl Street.
CHICAGO, 42 So. Clinton Street.

BRIDGES BERLIN BUILDINGS

OUR CATALOGUE
OF THREE HUNDRED PAGES ILLUSTRATING AND DESCRIBING A LARGE NUMBER OF

BRIDGES BUILDINGS AND ROOFS

Designed and Built by us
Is now ready and will be sent on application.

THE BERLIN IRON BRIDGE CO.
EAST BERLIN, CONN.

Steel Dynamos and Motors, 8, 15, 20, 35, 50, 100, 200, 300 and 500-light machines, ½, 1, 2, 3, 5, 10, 15, 30 and 50 h. p. motors. State what you want and get our prices before ordering. **The HOBART Electric Mfg. Co., Troy, Ohio.**

Digitized by Google

COLOR YOUR LAMPS

CRYSTAL CHEMICAL COLORING. INDESTRUCTIBLE EFFECTS.

Ruby Red, Blue, Pink, Ground Glass, Opal White, Yellow, Green, Purple.

WEBSTER CHEMICAL COMPANY,

400 SIBLEY STREET, ST. PAUL.

PEERLESS

A High Grade Incandescent Lamp.

NOT A NEW LAMP BY ANY MEANS, BUT A NEW NAME.

This name was chosen because it expressed all the superior merits of the lamp itself.

FILAMENT The filament is of a superior quality and like good wine, improves with age.

VACUUM By our new process of chemical exhaustion, we have attained an extremely high degree of vacuum.

MOST LIGHT FROM LEAST CURRENT. LONGEST LIVED.
HIGHEST EFFICIENCY. SYMMETRICAL IN DESIGN.

The Warren Electric & Specialty Co., Not in the Trust. WARREN, OHIO.

SPRINGS

OF EVERY DESCRIPTION-FLAT OR ROUND WIRE, STEEL OR BRASS-A COMPLETE ASSORTMENT OF HIGH GRADE

COLD ROLLED STEEL

KEPT IN STOCK..003 TO .049 IN THICKNESS.

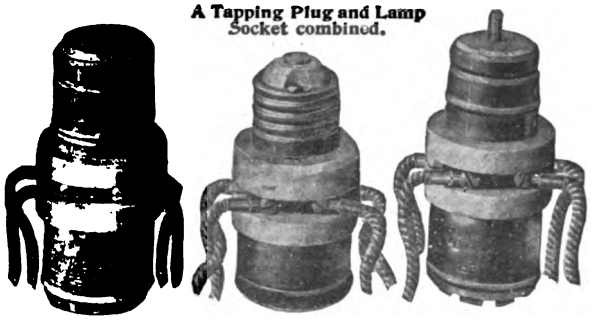
SPRINGS ENAMELED OR PLATED. TEMPERING DONE AT SHORT NOTICE
RIBBON STEEL MADE TO ORDER — SEND SAMPLES & WRITE FOR QUOTATIONS.

THE WALLACE BARNES CO. BRISTOL, CONN. EST. 1857

In writing advertisers, mention of The Electrical Engineer will be esteemed a favor. . . .

The Vetter Current Tap.

A Tapping Plug and Lamp Socket combined.



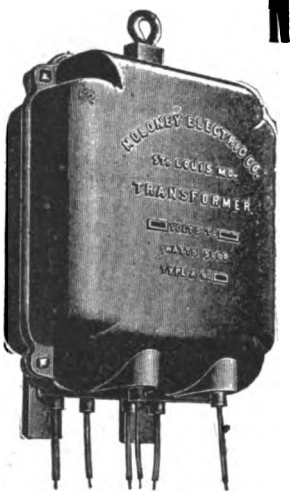
A simple and safe device for tapping and carrying the current from any electric light fixture to Motors, Drop-lights and other electrical devices, WITHOUT THE LOSS OF LAMP IN FIXTURE. Adapted to any system of electric lighting. When ordering, state what socket is used. Each tap is packed, with full directions, in a neat box.

FOR SALE BY ALL ELECTRICAL SUPPLY HOUSES.

Send for Descriptive Circular and New Discount Sheet.

E. B. MEYROWITZ, Manufacturer and Patentee, 104 E. 23d St. N. Y.

THE NEW TRANSFORMER



HIGHEST EFFICIENCY.
SMALLEST CORE LOSS.
CLOSEST REGULATION.
PERFECT VENTILATION.
GUARANTEED against Burn-out for TWO YEARS.

Send for particulars to

MOLONEY ELECTRIC CO.

2d and Vine Sts., ST. LOUIS, U. S. A.

FLAWLESS FAULTLESS FINISHED

In a word PERFECT! in its truest sense is the

IMPROVED POWERS ARC-LIGHT CUT OUT.

One on which you can rely to do its duty and do it well.

WATER-PROOF IRON-CLAD CASE and INSULATED WIRE HOLES.

Send for Catalogue and Prices.

The E. G. Bernard Co., TROY, N. Y. U. S. A.

The Potomac Terra Cotta Co.

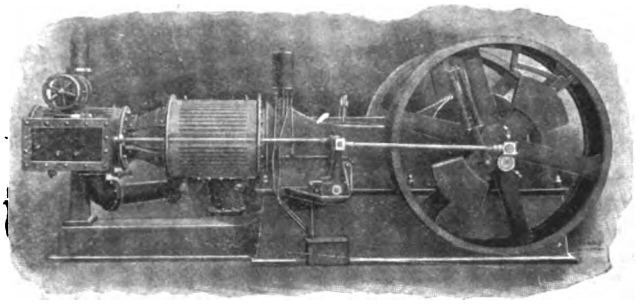
36 Corcoran Building, WASHINGTON, D. C.

Secured by Letters Patent, duly assigned. Other claims are now pending.—

Manufacturers of

Terra Cotta Conduit for Underground Electric Wires.

Digitized by Google



The steady and increasing favor in which any article is received is the best evidence of its merit. This has been the history of our engine during the fifteen years of its existence, and our engines have been our best advertisements. The highest quality of materials and workmanship are used in their construction. They cost less for maintenance, are economical and reliable, embody all modern improvements, and for these reasons deserve and command higher prices than others.

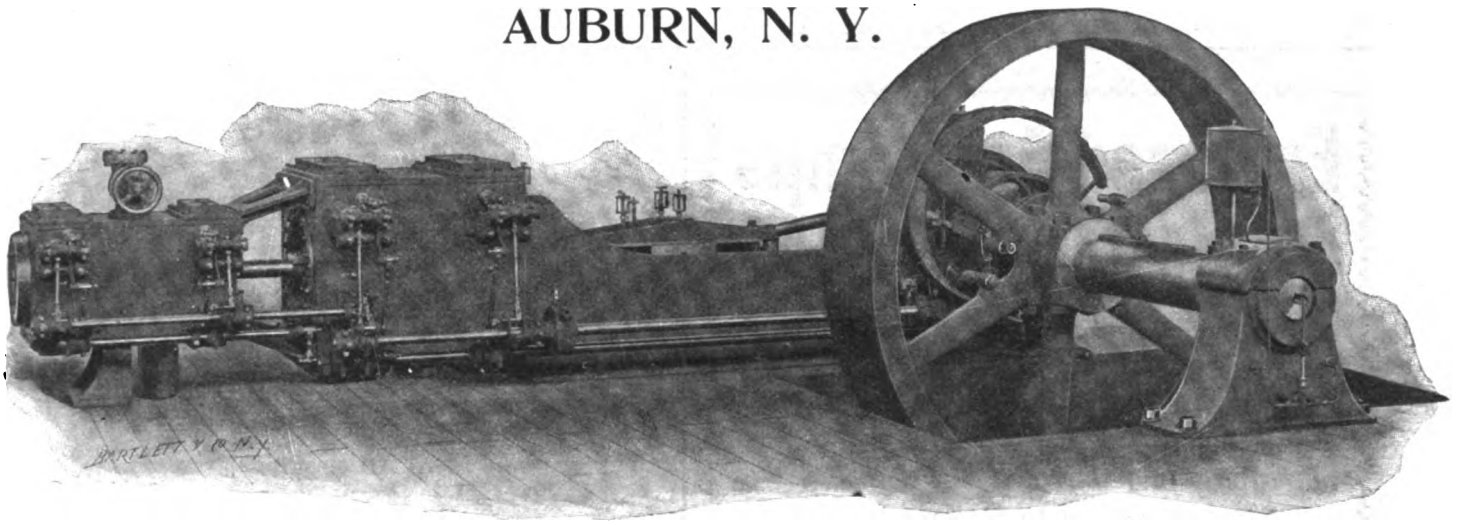
THE BALL ENGINE CO.,

Chicago Office:
1526 Monadnock Block.

Erie, Pa.

McINTOSH, SEYMOUR & CO.,

AUBURN, N. Y.



HORIZONTAL TANDEM GRIDIRON VALVE ENGINE ARRANGED FOR DIRECT-DRIVEN GENERATOR.

ALL TYPES AND SIZES....

High grade Gridiron Four-Valve Engines, with separate steam and exhaust eccentrics, and **Positive** Valve Gear. **Economy, Durability and Close Regulation.**

Heavy Engines for Railway or Mill Work a Specialty.

NEW YORK,
McINTOSH, SEYMOUR & CO.,
1011 Havemeyer Building.

SAN FRANCISCO,
C. C. MOORE & CO.,
32 First Street.

BOSTON,
J. A. GRANT & CO.,
8 Oliver Street.

European Representative, R. W. BLACKWELL, 39 Victoria Street, Westminster, London, S. W.

SOUTHWARK FOUNDRY & MACHINE CO.,

PHILADELPHIA, PA.

BUILDERS OF

REFINED AUTOMATIC CUT-OFF ENGINES
FOR ELECTRIC LIGHTING AND POWER SERVICE.

Our Porter-Allen Engines of horizontal and vertical type, simple compound, triple and quadruple expansion, in sizes up to 2,500 economical horse-power, are running in various central station and isolated electric plants throughout the country.

INQUIRIES SOLICITED.

THORBURN REID,

CONSULTING ENGINEER.

ELECTRICAL—Power Transmission, Electric Railways, Central Stations, Isolated plants. Machine Design. HYDRAULIC—Water Power Development REFRIGERATING — Complete Ice Manufacturing or Cold Storage Plants.

Telephone, No. 2708 Cort

120 LIBERTY ST., N. Y. City.

L. H. LANCASTER,

ELECTRICIAN.

Best of College Training and Good Testimonials.

ADDRESS:
BLACKSBURG, VA.

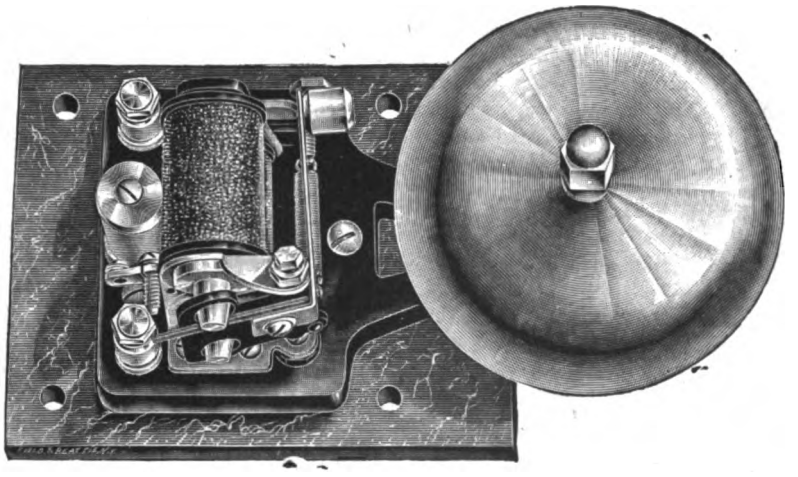
SPECIALTIES:
Electric Lighting, Electric Bell Fitting and General Telephone and Line Construction.

Armington & Sims Company,

PROVIDENCE, R. I.

High Grade Steam Engines to meet the requirements of any service. *Write for Catalogue.*

Digitized by Google



SINGLE STROKE or VIBRATING **BELLS**

for **DIRECT** or **ALTERNATING CIRCUITS.**

ANY VOLTAGE.

EDWARDS & CO.,

144th STREET & 4th AVE. *New York.*

(8)

Enclosod Arc Lamps

THE UPTON "MIDGET"

For Low Tension, Constant Potential Current
110 Volts. 3 to 6 Amperes. 150 Hours.

For High Tension, Series Circuits,
4 to 7 Amperes. 125 Hours.

For Alternating Current,
6,000 to 16,000 Alternations. 125 Hours. Noiseless.

For 220 or 500 Volt Circuits { Two or Five in Series.
3 to 5 Amperes. 125 to 150 Hours. Automatic Switch.

For 220 Volt Circuits—to burn singly.
150 to 160 Volts at Arc. 2½ Amperes. 125 to 150 Hours.

BEST IN THE MARKET!

ABSOLUTELY STEADY WHITE LIGHT!
NO PARTS TO WEAR OR GET OUT OF ORDER!

The Upton Open Arc for all Circuits.

SEND FOR CATALOGUES NOS. 31 AND 33.

Standard Thermometer and Electric Co.,
PEABODY, MASS.

AGENCIES:—NEW YORK, PHILADELPHIA, CHICAGO, NEW ORLEANS, SAN FRANCISCO, MONTREAL, LONDON, Eng.

Hours 150- **PIONEER** -150 Hours

Enclosed Arc Lamps are the

STANDARD

Pioneer Lamps embody best mechanical design and highest electrical efficiency.

All circuits

110--220--550 VOLTS,
3 to 5 AMPERES, and

ALTERNATING CURRENT CIRCUITS.

ELECTRIC ARC LIGHT CO.

120 LIBERTY ST., NEW YORK.

WATER WHEELS

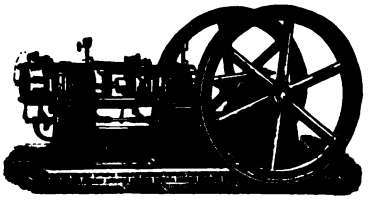
For Heads of 3 Feet to 2000 Feet.

Especially adapted to all kinds of

ELECTRIC POWER and LIGHTING PLANTS

Recent tests at Holyoke enable us to guarantee:
The largest Power ever obtained from a wheel of the same dimensions. The highest speed ever obtained for the same power. The highest mean efficiency when running from half to full gate.
We guarantee also: *A runner of the greatest possible strength. A gate unequaled in quickness and ease of opening and closing.*
State your Head and send for pamphlet.

JAMES LEFFEL & CO., Springfield, Ohio, U. S. A.



FRONTIER GAS ENGINES

FOR ELECTRIC LIGHTING PLANTS.

Two Cylinders—Tandem. Unexcelled Regulation. | Send for Circular. | An Impulse Every Revolution. Highest Type of Construction.

THE YARYAN CO., Eastern Agents, TIMES BLDG., NEW YORK CITY. | **FRONTIER IRON WORKS** 12 CHENE ST., DETROIT.

Digitized by Google

A WINTER'S DAY

With its mist and rain will find almost every office a darksome place unless artificial light is employed. That's the point—when you employ that sort of light you want to make the most of it and there is no such aid to that end as WHEELER REFLECTORS. They are made to suit a thousand different conditions, are ornamental in appearance and retain their finish.

WHEELER REFLECTOR CO., Boston, Mass.

WE CARRY IN STOCK A COMPLETE LINE OF

Gas and Electric Fixtures

AND

ELECTRICAL SUPPLIES.

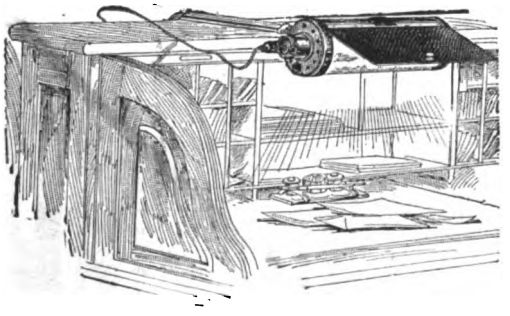
Chicago General Fixture Co.,

169 ADAMS STREET, CHICAGO.

Western Selling Agents: W. C. VOSBURG MFG. CO.

BEWARE OF SPURIOUS IMITATIONS

OF



The Kinsman Desk Lamp.

The only fixture made which will properly light the desk and at the same time shield the eyes. Send for pocket catalogue and price list.

McLEOD, WARD & CO., 27 Thames St., New York.

When writing Advertisers kindly mention THE ELECTRICAL ENGINEER. . . .

SERIES LAMPS

...For all... Circuits and Systems

(Made by our New Process.)

STANDARD AMPERAGE— ANY CANDLE POWER

Our Lamps have been in competition with others in recent tests and we received the orders in every instance.

BEACON LAMPS

Have long life—blacken less than others by 75 per cent., thus retaining candle power and brilliancy—and save a lot of trouble : : : : : : :

Send us a trial order for MAKING YOUR OWN TEST

BEACON LAMP CO., New Brunswick, N. J.

THE PARAGON...

Where a cheaper reflector is wanted we have a style of the "deep cone" order which is especially desirable where a number are required such as over reading tables, machines, desks, etc. They are green outside and glossy white enamel inside (from 8" to 12" in diameter), quite durable and strongly made and throw a powerful light (but not quite as much as our mirror-glass reflectors).

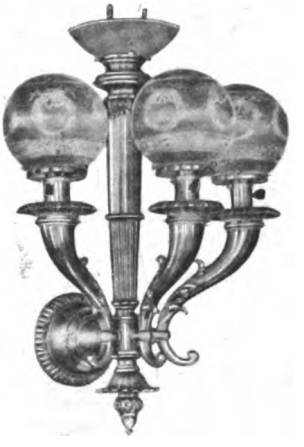
WRITE FOR PRICES PER DOZEN.

American Reflector & Lighting Co.

CHICAGO, ILL.

THE

HORN & BRANNEN MFG. CO.

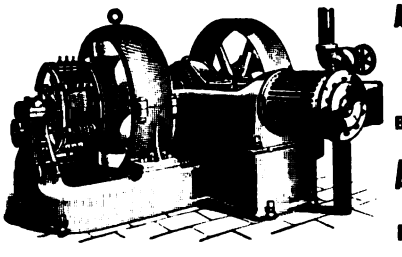


Manufacturers of

Gas and Electric Light Fixtures.

Manufactory and Salesrooms:

427, 429, 431, 433 North Broad St., PHILADELPHIA.



AMERICAN BALL ENGINES AND ELECTRIC MOTORS AND GENERATORS,

Both Belted and Direct Connected.

AMERICAN ENGINE CO.,

32 RARITAN AVE., BOUND BROOK, N.J.

Digitized by Google

ALL TELEPHONE COMPANIES....

Should have one of our valuable Sample Cards of **Special Paranite Wire** for **Telephone Work,** showing samples of the following :

No. 19, Single Conductor	- - -	**Plain.**
No. 19, " "	- - - -	**Braided.**
No. 19, Double " "	- - -	**Twisted Plain.**
No. 19, " "	-	**Twisted Saturated Braid.**
No. 19, " "	-	**Twisted Glazed Braid.**

The above wires should be used by every Telephone Company to secure perfect service.

ELECTRIC APPLIANCE COMPANY
Electrical Supplies
242 MADISON STREET, - - - - - CHICAGO

TRADE MARK.

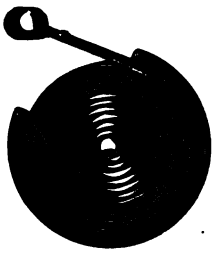
Announcement.

The "NEW RIVAL" Incandescent Lamps now ready for immediate shipment. They successfully compete in quality for *every point of superiority* known in the art of incandescent lamp making.

OUR SPECIALTIES: 2, 4 and 6 c. p. for 50 and 110 volt circuits and high efficient central-station lamps.

Prices on application. May we not send you a trial order.

JOHN KAMMER COMPANY,
176-178 Indiana St., CHICAGO.



CARY SPRING WORKS,

240 and 242 West 29th St., New York City.

Manufacturers of

WIRE and SPRINGS

of all kinds.

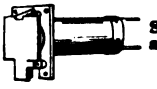
Tel. 3346 38th St.

SAMSON SPOT CORD

FOR ARC LIGHT AND TROLLEY CORD.

Send for Samples and Prices.

SAMSON CORDAGE WKS. BOSTON, MASS.



THE MAYER DROP

SINGLE and DOUBLE POLE ACTION. SPRING JACKS, and PLUGS and TELEPHONE SWITCHBOARD SUPPLIES

Geo. M. Mayer Model and Machine Works,

Write for Catalogue. 79 FIFTH AVE., CHICAGO, ILL.

KEYSTONE INSTRUMENT ELECTRICAL COMPANY

901 MONTGOMERY AVE NEW YORK
15 CORTLANDT ST CHICAGO

PHILADELPHIA.

SWITCH-BOARD AND PORTABLE INSTRUMENTS POLARITY INDICATORS GROUND DETECTORS.

HIGHEST GRADE NUERNBERG CARBONS

FOR ENCLOSED LONG BURNING ARC LAMPS,
FOR DIRECT CURRENT,
FOR ALTERNATING CURRENT
ARC LAMPS.

ELECTRA CARBONS

ELECTRA TRADE MARK

UNEQUALED IN QUALITY AND EFFICIENCY.
PRODUCE EXCELLENT, UNIFORM, STEADY AND BRILLIANT LIGHT.

HUGO REISINGER 11 BROADWAY, NEW YORK.

Digitized by Google

The Electrical Engineer.

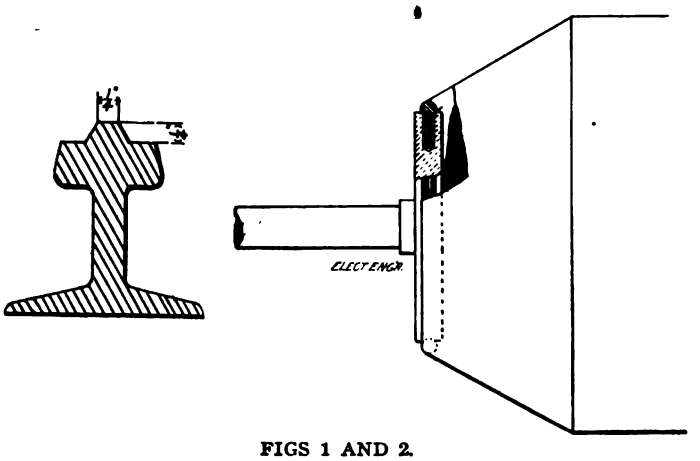
Vol. XXVI. DECEMBER 29, 1898. No. 556.

MISCELLANEOUS

Practical Balancing of Armatures.

BY GEORGE T. HANCHETT.

IN any mechanism which must operate without vibration, the rapidly rotating parts require to be balanced. This is especially true with dynamo armatures. An armature is built up of many parts and even though the result is symmetrical to the eye, the structure may be seriously out of balance due to variations in the weight of the materials which enter into its construction. For instance, the insulation may be thicker in some places than in others, or may be more solidly put together. The core disks are not always of the same thickness throughout, and frequently the heavier parts are bunched together. If the armature core is constructed of disks set up with a nut and end collar, a very popular method, the shaft may be sprung slightly. All of these things may combine to unbalance the armature.



FIGS 1 AND 2.

Aside from the noise and vibration which an unbalanced armature emits when running, its life is seriously abridged, for the action of vibration on the insulation is such as to destroy its structure. It becomes brittle and after several years of service even crumbles to powder. Repair men, in taking apart old armatures, have noticed that the paper and cloth insulation could be powdered up with the fingers, and was about of the same mechanical strength as a baker's thin cracker. This change in structure is largely due to heat and vibration.

A number of suggestions have appeared in the technical papers with regard to the balancing of armatures. The writer has entertained some ideas on this subject which for a long time he believed were common property, but as none of the recent articles have seemed to mention them, he ventures to submit them to those who may be interested.

An armature may be out of balance in two ways, which the writer has been wont to designate as static and dynamic unbalancing. If an armature is out of static balance, it is out of dynamic balance also, but it is perfectly possible for an armature to be statically balanced and yet unable to run smoothly when operated at a high speed.

Modern armatures, which are mostly of the multipolar type, are large in diameter with respect to their length, and are comparatively easy to balance by the ordinary static methods. In this method a common way is to provide two accurately planed rails, which are placed both parallel and level, and the armature armed on either end of the shaft with a hardened collar, is placed upon them. The heavier side sinks and the ordinary process is then to tie lumps of solder on the armature at various places until it will remain stationary at any angular position on the rails. A suitable rail may be made from a light T rail by planing a one-quarter inch rib on the top as shown in Fig. 1.

Having determined the proper amount of weight, it must be fastened permanently in a corresponding position on the armature, and this is not always an easy matter. With long drum armatures of small diameter the most common way is to melt the solder and sweat it on the band wires. This method is open to the objection that eddy currents are liable to be created in the bunches of solder, thus melting it apart, and therefore if the unbalancing is considerable, some other means must be resorted to. A favorite way is to fasten an iron ring to the head of the armature by means of stout cords and load it with leaden plugs. The canvas head covers up this ring, which is not usually symmetrically put on, and therefore would be unsightly.

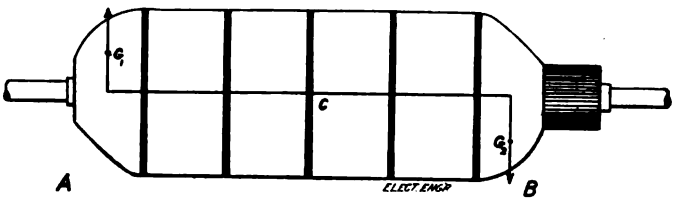


FIG. 4.

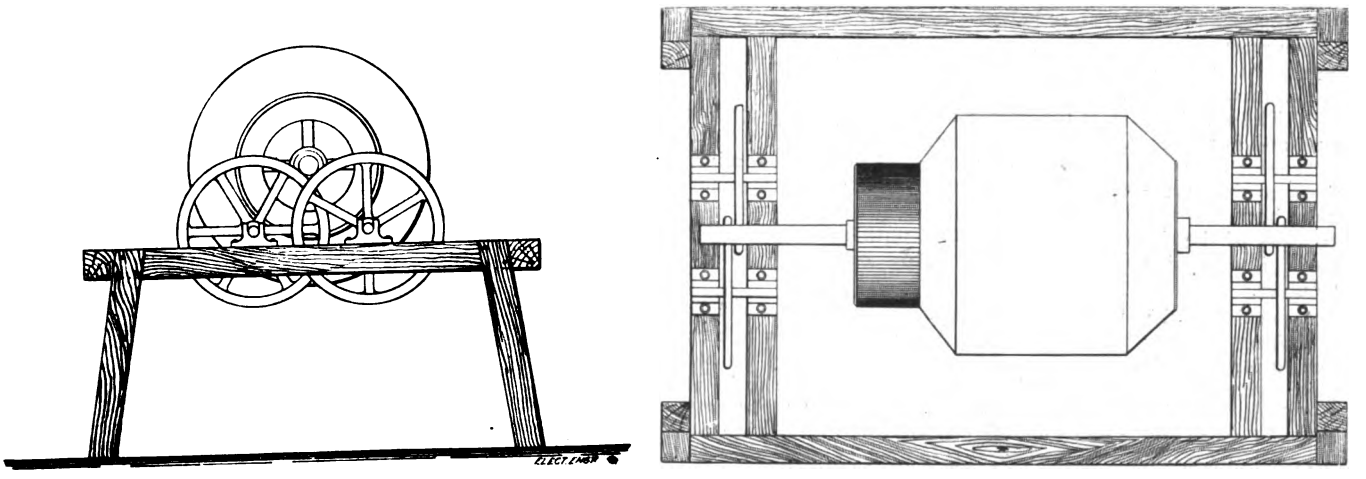


FIG. 3.

A better way of providing a place whereon to load balancing weights is to use a metal ring to which the canvas head is tied, instead of the fibre disk often used for such purposes. The edge of the disk should be grooved to receive the canvas and drilled to receive the counter weights. It will be found better to drill

Digitized by Google

the ring before balancing, at equal distances around the circumference, and to equal depth. These holes may then be filled with the proper amount of solder, or preferably type metal which will expand on cooling and fit tightly in the holes. Fig. 2 will assist in explaining the method. Inasmuch as the commutator lugs usually form the collar for the heading on that end, it is necessary to locate the metal collar on the other end. It must, of course, be appropriately insulated by collars of fibre or other suitable material.

A prolific source of error in the balancing of armatures is found in the balancing rail, for the shaft of the armature is often very strongly magnetized. In such machines as the Stanley-Kelly alternator and the Lundell dynamo, where the magnetizing coil surrounds the armature, this effect is liable to be particularly pronounced. This magnetization causes the shaft to stick to the balancing rail, which impairs the accuracy of the result. The difficulty may be avoided by using collars on the shaft which are thickly lined with babbitt or zinc, thus breaking the magnetic contact. Aluminum bronze rails may be used with light armatures.

The writer prefers a set of anti-friction wheels to rails, as being a more sensitive device, but they have the disadvantage of being a permanent fixture and a machine in themselves; but the expense is justified by the greater accuracy. Such a set of wheels is shown in plan and elevation in Fig. 3.

Unfortunately an armature that is in static balance is by no means in rotary balance also. This will be more clearly shown by consulting Fig. 4. Suppose that an accumulation of wire at the end A had its centre of gravity at G^1, and was statically balanced by a similar accumulation of wire at B the centre of gravity of which is at G_2. Such an armature might easily be in static balance, but when it is rapidly rotated the centrifugal force of each of the unbalanced heads forms a couple which tend to turn the armature about the centre C, and failing to do this, presses the shaft against the bearings, which, as it revolves, causes great vibration. A familiar example of this may be shown by lifting the rear wheel of an ordinary bicycle from the ground and driving it at great speed by means of the crank and allowing it to run. The frame will sway from side to side, due to the fact that the pedals describe circles in different planes, and yet it will be found that the bicycle is in perfect static balance. This variety of vibration is reduced by narrowing the tread, thus bringing the pedals nearer to the same plane of rotation and thereby reducing the arm of the disturbing couple. This variety of unbalancing occurs in armatures and is impossible to detect by static methods.

A rough and ready method to detect it is to swing the armature in a lathe, slack off the centres and apply a piece of chalk to the sides. If the armature is in perfect static and rotary balance the chalk will draw an even line anywhere upon it, but if the armature is not in rotary balance, the chalk will draw a short line opposite the offending centre of gravity. The trouble should be sought at the ends of the armature, for it is there that lack of symmetry and consequently lack of balance is likely to prevail. The middle part of the armature is usually quite symmetrical and not likely to be out of balance.

Trouble on account of lack of rotary balance is becoming a thing of the past, since modern symmetrically wound armatures have been introduced. The old over-wound drums were the creators of the difficulty. Their great length and the irregular wad of wire at either end were highly conducive to such troubles.

A peculiar and most annoying case is an armature which has a shifting centre of gravity. It absolutely cannot be balanced until it is repaired. The source of the trouble is usually the complete pulverization of the insulation between the core disks and the shaft. This insulation was at one time thought to be essential, and considerable pains were taken with it; but varying temperature and vibration soon reduces it to powder, giving the core disks a chance to play from side to side on the shaft. The Edison armatures of the earlier types employed a wooden sleeve for this purpose, and in rebuilding such a core a cast-iron sleeve forms an excellent and permanent substitute. In armatures where thin insulation, such as paper, is employed for this purpose, it is not so easy to find a satisfactory substitute. The best method is to take a strip of sheet iron of the proper thickness and wind it spirally around the shaft, taking care not to lap the joint. A single sheet of iron surrounding the shaft could not be made to hug it tightly enough so that there would not be some play.

The Necessity for a Naval Electrical Engineer Corps.

BY F. W. ROLLER.
(Late Chief Engineer, U. S. S. Nashville.)

DID any of your readers notice in the papers a short time since the report of the Board on Naval Construction regarding the extension of the application of electric motors for driving auxiliary apparatus on board the new battleships "Ohio," "Maine" and Missouri"? As there set forth it was decided to negative the propostion that the auxiliaries, other than the fans, steering gear, turrets and ammunition hoists, be electric motor driven on the ground that trouble has already been experienced with some of the motors used on the present ships.

Is this a sufficient ground for their action? It would certainly seem clear that with the art of motor building in the advanced stage in which it is to-day; where the machines are used in mines, in oil refineries, in foundries, run through slush and snow on street cars; unmercifully abused by unintelligent operators in these places and elsewhere and still giving far less trouble than any other source of power before tried, that the argument of unreliability is invalid. It is not contended that the motor is a piece of machinery that requires no attention whatever, but that the attention required is a minimum, an assertion surely borne out by the results daily attained in practice.

The true reason for the hostile attitude assumed by the navy will probably be found to exist, not for the reason that trouble is possible or has been found in use, but that such trouble when developed is more difficult for them to locate than a mechanical break or leak, which might occur in other prime-movers, and the method of location is not the "take down and inspect" that applies in this latter case.

A large element of mystery still hovers over electricity in general in the minds of many of those in authority and who would be responsible for the performance of whatever appliances are used which is augmented by the delicacy and accuracy of the instruments given to them for testing purposes. The great objection is that they have nothing palpable to deal with —you can't see the "juice," nor smell it, nor hear it, and therefore it is altogether out of line with what they have been in the habit of dealing with.

It is to be feared that the other side of the question, i. e., that while the trouble may be more difficult to locate, it is far easier to remedy when found, especially with the necessarily limited facilities available on shipboard, is not sufficiently appreciated. Compare also the time required to true off a piston rod and renew the packing with that required to take out an armature and dress down the commutator. These cases may be assumed to be parallel and like many others that will suggest themselves to the mind of the reader, show a marked element in favor of the motors.

If we run over the installation on one of the typical American battleships as built to-day we will find still further reasons why the best results are not obtainable. Starting in with the generators, we find a great improvement over those specified up to a year or so ago in that the machines are practically of the ordinary multipolar compound-wound type, with iron-clad drum-wound armatures, carbon brushes and so on, differing only from the best commercial machines of the same general size in their voltage, which owing to the necessity of being able to operate searchlights is 80. The engines, too, are far better than the single or twin cylinder simple type formerly employed and of greater economy in the use of steam. It cannot be said, however, that even now they are as economical as they should be, for the electrical equipment, including the engines, is in charge of and operated by, not the engineering department, as would naturally be expected, but a line officer, so that they have been ordered built with more regard to their ability to run for extended periods under untrained men without necessity for overhauling and adjusting than for the economy that could just as well be obtained with the same degree of satisfactory performance were skilled engineers in charge.

The location of the generating sets in two different parts of the vessel, as has been done on the new battleships, is also open to criticism. Not only is the attendance required increased, but the units themselves have been selected of different types so that the advantage of uniformity is lost. The plants are not even independent of each other, the fields of one being excited from the other's circuit, so that the liability of a set being dis-

Digitized by Google

abled is not diminished, but rather enhanced. It would seem far better to group the sets, exciting all their fields from the common lighting busses, as would be necessary with the system of control of the turret motors that is employed, thus obtaining greater flexibility and less complication. The valuable space below the protective deck thus required would be but grudgingly given, but it is easy to show that by the proper and intelligent extension of the use of motors, the loss is only apparent, there being a real gain.

In the case of the "Minneapolis," for instance, it may readily be calculated from the results of the exhaustive tests made on the steam consumption of her steam driven auxiliaries by P. A. Engineer W. W. White, U. S. N., and published by him in the "Journal of the Society of Naval Engineers," that sufficient coal would have been saved in a seven days' run to do away with a bunker space calculated on the basis of forty-three (43) cubic feet per ton, ample to hold all the lighting and power units and all over this would be clear gain.

Let it be understood that the gain would not be in fuel alone. It was demonstrated in our war with Spain that fresh water was as important a factor as coal, and that the make-up feed necessary for the boilers added to the water needed by the crew was far in excess of the capacity of the distillers, these latter equipments being of themselves of a type far inferior in efficiency to the multi-stage class, which are used on distilling ships where sufficient space is allowed. As the water lost is largely that caused by the steam leakage past piston and valve rods, it is apparent that there will be an immense saving in this respect, also due to the decrease (in the case of the "Minneapolis" of from fifty-two (52) to eight (8)), steam cylinders other than those of the main engines ordinarily in use. Would not this alone be a potent argument? Of course, simplicity and certainty of operation are vital in a case of this kind, but a geared outside packed plunger pump is simple and sure, if it has any merits at all; and a motor-driven winch, centrifugal pump, ash hoist or blower, has fewer parts needing adjustment and repair than its steam-driven equivalent could have under any circumstances.

It is believed that the above arguments in favor of electric motors are irrefutable, that by no twisting of theory or fact can a system of electric-driven auxiliaries receiving their power from a single station located below the protective deck be made to appear inferior in economy, safety, ease of repair, bulk, reliability, ease of control, flexibility or negative effect on the condition of the living and working spaces to any system employing other means of power transmission; and in the majority of these vital points it exceeds them all markedly.

We are obliged then to return to our original theory that the men and not the apparatus are at fault. This does not mean that it is necessary that all who have to handle a piece of machinery are to be electricians or even to be specially instructed in the operation of their machine. A street car is put in charge of men of no technical training or experience whatever with the briefest possible instructions for its operation with eminently satisfactory results. In a street railroad system there is simply a small staff of men, true electrical engineers, who organize and superintend the work of a corps of electrical inspectors who may be properly defined as "electricians." These make regular inspections and tests on the car equipments, detecting and having rectified any incipient defects, and replacing parts where needed. The shop where the actual work of repairing is done is then the last link in the skilled labor chain, the men required there being simple electrical artisans, whose work is no more difficult to learn or to do when learned than that of a machinist. This is broadly the method employed on large roads using many times the power that a battleship requires.

The navy should be able to obtain results equally satisfactory with a much smaller force. A single technically educated engineer with the rate of a commissioned officer should be in charge of all electrical apparatus and appliances in general. Under him have one or more electricians, petty officers, with a sound practical commercial training to keep watch on and make periodical tests of the machinery as well as to take personal supervision of repairs. Under them again have second or third class petty officers to do the actual work of repairing. This would by no means increase the force required aboard. The present steam engineer force would be diminished in just the same proportion that the electrical engineer force would be employed; or could, if it were deemed wiser by the authorities in Washington, be made part of or subordinate to this department, the electrical engineer being responsible to the chief engineer direct for his portion of the appliances.

No objection can be raised that this will complicate matters and lead to a division of responsibility that is undesirable.

In a service like ours where, taking this very case of electric apparatus in point, the engine and a part of the electrical appliances are made under specifications drawn by the Bureau of Equipment, and another part under those of "Construction," and where, when installed, the plant is under the charge of the ship's navigating officer and run entirely by his men, we would in reality be simplifying the situation and obtain results commensurably satisfactory.

The writer wishes it understood that he is in no way calling in question the undoubtedly splendid training of our naval officers, nor their high abilities, but no one can be an expert in a multiplicity of lines and when an officer who has been ordered on one tour of duty as expert and inspector of forgings for armor plates and guns, on another in the same capacity as regards small arms, on another for projectiles, going then as a meteorologist, surveyor, shipbuilder, and so on in endless profusion, we cannot expect that when the next tour comes he can sit down to design and specify an electrical equipment for a vessel that will compare favorably with a specialist's work; nor can he be expected to operate it when installed as such an expert would. It is further natural from this that with the plants as at present installed, there should have been some trouble; the only wonder is that this has not been greater.

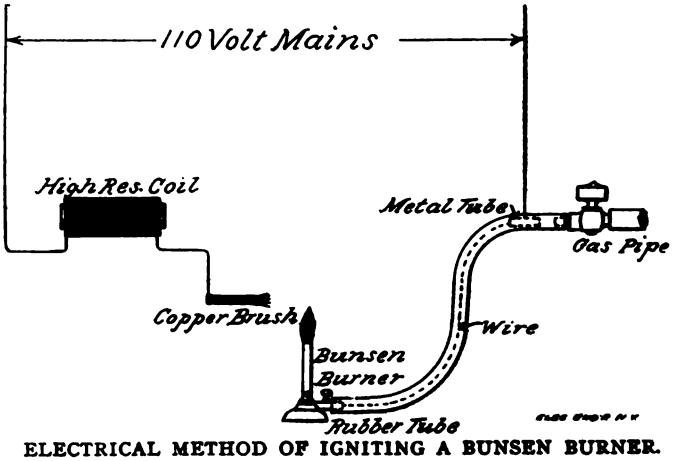
Let us therefore go to the root of the trouble and organize an electrical engineer corps in the navy. It may and doubtless will be fought against just as was the steam engineer corps, but it is essential just as the latter was and is bound to come.

When we have it, and it lays out on sound engineering principles the extensive equipments that are needed, taking direct charge of these afterward, we will hear no more of the "unreliability of motors," but through the saving in weight of coal and water carried, will have room for the extension of the numerous other vital features of that great floating compromise between conflicting demands, the modern war vessel.

A Wrinkle in Electric Gas Lighting.

BY J. R. CRAVATH.

AN experimental electrical laboratory recently visited by the writer had Bunsen gas burners of the kind commonly used in laboratories for heating small articles, but no matches were to be seen or found around the place. The electrician in charge laughlingly said they had an electric gas lighting system but it was not of the orthodox kind. The burners were lit from the arc caused by the breaking of a circuit of high self-induction. While this might seem to involve very complicated apparatus



ELECTRICAL METHOD OF IGNITING A BUNSEN BURNER.

it was accomplished in this case very simply. The burner was connected to one side of the circuit and the arc was drawn between it and a copper wire brush connected to the other side of the circuit. The self-induction was furnished by a magnet in series in the circuit.

The accompanying sketch shows the arrangement of circuits. Over the bench so located as to be easily in reach of the gas

Digitized by Google

burner is fixed a copper brush made of the frayed ends of incandescent lamp cord. This brush was connected to one side of a 110-volt circuit in series with a large magnet wound with fine wire and consequently having high self-induction. The magnet was also of course available for other experimental purposes. The Bunsen burner was connected to the other side of the 110-volt circuit by a wire running inside the rubber tube connecting it to the gas cock. Before reaching the gas pipe, however, a short length of metal pipe was inserted in the rubber tube and connection was made to this to avoid grounding the circuit on the gas pipe, all of which is made plain by the sketch. To light the burner, gas is turned on and the tip of the burner is simply touched to the brush and drawn away again. The circuit is closed as soon as the burner touches the brush. When the burner is taken away a flash ensues because of the high self-induction of the circuit, and the gas is lit. The method as installed there is entirely safe and eliminates whatever fire risk may be connected with matches as well as saving time and making it more of an inducement to turn out the gas when it is not wanted.

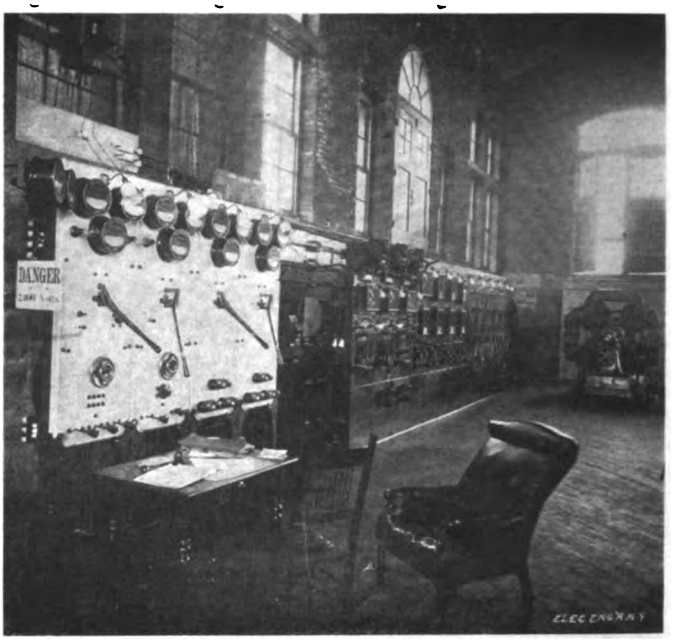
The Development of Niagara Power in Canada.

BY ORRIN E. DUNLAP.

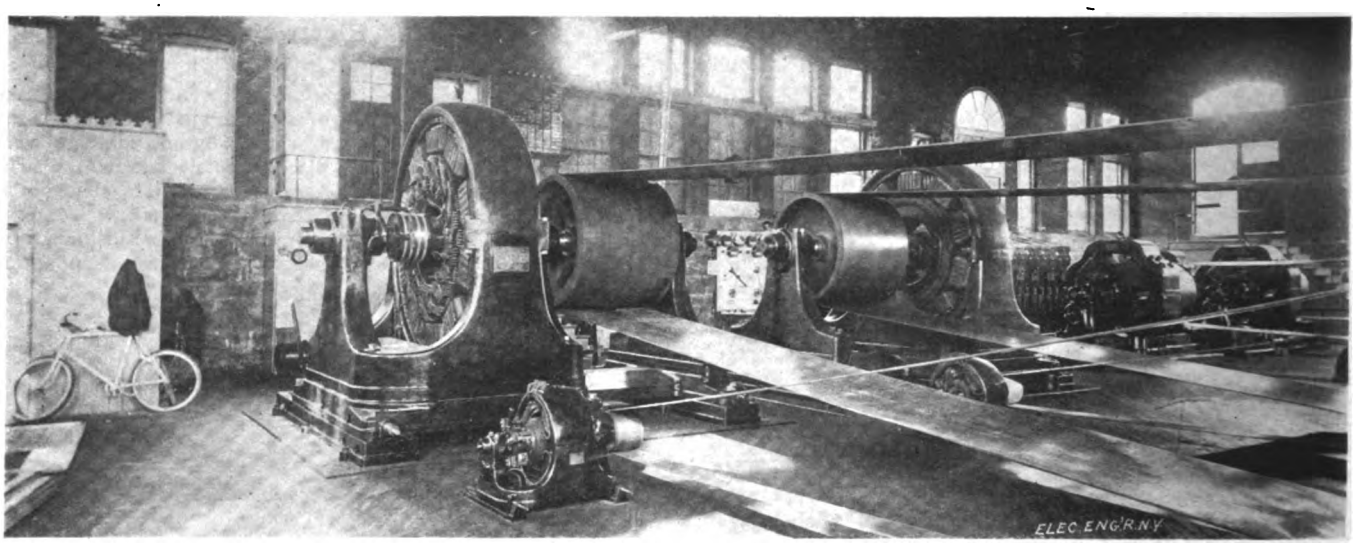
THE Province of Ontario, and especially that portion of it in the immediate vicinity of Niagara Falls, is very much stirred up over the question of the development of the power of Niagara on the Canadian side. In April, 1892, the Canadian Niagara Power Company entered into an agreement with the commissioners of Queen Victoria Niagara Falls Free Park, which agreement was ratified by the Ontario government, whereby the Canadian Niagara Power Company secured exclusive control of the right to develop power in Queen Victoria Niagara Falls Free Park for an annual payment of $25,000 a year for the first 10 years, the amount to be increased $1,000 for each year of the second decade until the annual rental shall have reached the sum of $35,000, at which rental it may be continued 80 years longer.

It was provided in this agreement that the Canadian Niagara Power Compay "should have preceeded so far with the said works on or before the first or November, 1898, that they will have completed water connections for the development of 25,000 horse power and have actually ready for use, supply and transmission 10,000 developed horse power by the said last mentioned day." Some months ago, however, the Canadian Niagara Power Company applied to the park commissioners for an extension of time, and while the commissioners were favorably impressed with the request, the government is understood to have hesitated.

Then in order that all local demand for power might be supplied on the Canadian side of the river at Niagara, the Canadian Niagara Power Company arranged with the Niagara Falls Park and River Railway for the right to install in their power station, within the park limits, two 500 h. p. generators. This installation was placed by the Westinghouse Company under the supervision of their resident electrician, Mr. W. K. Dunlap. The Canadian Niagara Power Company's equipment thus consists of the two 500 h. p. generators, each of 3,000 alternations and developing power at a voltage of 2,200. These generators are belt driven by the two turbines of the Niagara Falls Park and River Railway Company, and the installation is so arranged that either turbine can drive either generator. The installation is well portrayed in the accompanying illustrations. From these generators, current is being supplied to the Carborundum Company, for the operation of its Canadian branch; to the Niagara Falls Electric Light and Power Company, and also to the Carmelite Monastery. Beyond this there has been no demand and much of the power of the two generators is still unused. For this reason the Canadian Niagara Power Company are understood to feel they have met the local demand, and realize, as the park commissioners have stated, that any great demand for power on



SWITCHBOARD, NIAGARA POWER TRANSMISSION, CANADA.



WESTINGHOUSE POWER GENERATORS, CANADIAN NIAGARA PLANT.

Digitized by Google

the Canadian side must be expected to come from Toronto and other cities requiring long distance transmission, which until now has been deemed doubtful of success.

Inasmuch as the Canadian Niagara Power Company did not have 10,000 developed horse power by November 1, 1898, the legality of their rights in the park have been questioned, and while there are governing provisions, the two parties concerned have instituted a friendly suit to ascertain the legal standing of the company in the contract. It is understood that the argument will be in the Divisional Court, Chancery Division, and the questions which the lieutenant governor in council, acting under the advice of the attorney general, but submitted to the court for decision:—(1) Is the agreement void by reason of the failure of the company to carry out its agreement with reference to the development of power? (2) May it be declared void and whether of the agreement with the company is not at an end are the government or commissioners of the park relieved from the provisions of the agreement under which they are restricted from granting or conferring upon any other company or person the right to take and use the waters of the Niagara river within the limits of the park?

It may be added that in October last the Canadian Niagara Power Company paid the commissioners of the park $12,500, the amount of the semi-annual payment of rental, which is due May 1 and November 1.

The Carborundum Company are just finishing an addition to their Canadian branch, and it is expected will be calling for more power in the near future, but the Canadian Niagara Power Company have a plentiful supply.

BURSTING OF A FLYWHEEL. The bursting of a 15-foot flywheel at the power plant of the Birmingham Traction Co., Pittsburg, recently, wrecked a 300 h. p. engine and damaged the building. No one was hurt.

The Mechanical Plant of a Modern Commercial Building.—IV.[1]

BY WILLIAM H. BRYAN, St. Louis, Mo.
(Member of the Society.)

(Conclusion.)

CONTRACTS AND PRICES.

IN view of the central location and general character of the building and its tenants, and the fact that the installation was intended to be a model one, there was great competition for the work. Furthermore, as all bidders were figuring on practically identical specifications, there was no chance to claim advantages due to superiority of apparatus or methods. The figures, therefore, were strictly comparative.

On account of this competition, the work was let at exceedingly low figures, as will be seen below, the usual profits being cut out, and in some instances, losses sustained. These figures should, therefore, be used with caution, and from 10 to 20 per cent. added when estimating the cost of new work. Due allowance should also be made for differences in the character of buildings and the service rendered, as determined by the peculiarities of the business carried on in it. This is wholly a question of experience and judgment.

The owners of the building under consideration did not feel warranted in supplying their tenants with a high grade plant, claiming that the lease did not require it. As the tenants had made a ten years' lease, however, and would have to meet the fuel bills, they agreed to pay part of the extra expense.

It was not definitely decided to put in a complete plant until final bids were in, and estimates of cost of operation, repairs, and maintenance had been made. Up to that time, the securing of all electrical—and even steam—service from a central station, was under serious consideration. The figures, however, showed a material saving by operating their own plant, due principally to the use of exhaust for heating.

Section A—Water-Tube Boilers.—Compound engines and electric elevators having been selected, requiring 303 boiler h. p., as already shown, it was thought safe to reduce the boiler capacity to three units of 150 h. p. each, two to do the ordinary maximum service. This was equivalent to 4,955 pounds of water per hour per boiler, from feed of 212 degrees Fahr. into steam of 125 pounds gauge pressure. Water-tube boilers proving not as high in price as expected, that type was selected, the boiler being the "O'Brien," made in St. Louis. This boiler is similar to the Heine, except that the steam and water drum is horizontal, and not parallel to the tubes; the front and rear water legs are wider at top than at the bottom, and the rear leg extends some distance below the lower tubes, as a settling chamber. Each boiler contained 1,411 square feet heating surface, including drums and tubes of the Hawley furnace, or 9.4 square feet heating surface per horse power. The grate surface (upper grates only) was 31.5 square feet; ratio grate to heating surface, 1 to 44.78. The cost of the three boilerrs set up, including Hawley furnaces, brickwork, foundations, and smoke-flue, as specified in Section A, was $6,288, being $13.97 per horse power, or $1.48 per square foot of heating surface.

The cubic feet of gross capacity of building—as usually computed by architects from outside lines, and from bottom of footings to top of roof—per rated boiler horse power, is 6,771 and 5,146 cubic feet of space heated, per boiler horse power. The space heated included only the actual indoor space, and omitted basement.

This section, and also Sections F and G, were let to Kupferle Bros. Manufacturing Company, of St. Louis, at the gross price of $16,511.

Section Aa—Common Boilers.—The lowest bid on ordinary boilers, as per specifications (Sec. Aa), was $5,997, being $3,397 for the boilers, and $2,100 for the Hawley down-draught furnaces, and $500 for the brickwork. The four boilers aggregated 524 h. p. The price quoted was, therefore, $11.44 per horse power, or 95 cents per square foot heating surface.

Section B—Elevators.—The selection of the elevator system presented the greatest difficulties. The bids based strictly on the specifications seemed excessive in price, and the owners directed that the data be revised, with a view of getting more reasonable figures. The capacity of the elevators was therefore reduced. The two passenger and two southwest freight elevators had their average loads cut down to 1,500 pounds, and the four north machines to 1,800 pounds, being required to carry these loads at the speeds specified. They were also to be capable of carrying the larger loads originally specified at reduced speeds. Wooden guide posts and strips were substituted for the steel T guides. The allowance for passenger cabs was reduced to $200, and the indicators omitted.

On this revised basis, the Sprague system was selected, at the price of $22,070, including ash-hoist and safety gates. This low price was due partly to the conditions already named, and was made possible by arrangements made with local parties for erection, under a Sprague expert. The four north elevators were to be of the "X 38" type, with solenoid control; and the four south elevators of the "Z" type, with pilot motor control.

To the above price should be added $3,134 for the cost of third engine and dynamo, etc., making a total of $25,204 for the elevator plant complete. The cost per cubic foot of building space (gross) for elevators alone was $.0072, and for elevators, with engine, dynamo, etc. $.0083. The cost per square foot of total floor space was: For elevators alone, $.105; with engine, dynamo, etc., $.12.

The selection of the electric elevator for this important installation was decided upon after a thorough investigation. They were found to be more economical in fuel than any other type—even the high duty hydraulic—on account of the light loads usually carried, and the corresponding saving in power. There was also some saving in first cost. The electrical plant afforded a much more compact arrangement in the engine room. As no pumping engines were required, and no tanks or accumulators, one reserve unit answered for both the lighting and elevator plants. The electric elevator has not, as yet, fully established its reliability and low repair account as well as the hydraulic, but the latest and best types seem to leave but little to be desired in these directions.

The steam elevators were, of course, the lowest in first cost, but were not given serious consideration on account of their large fuel consumption.

Section C—Dynamos, Switchboard, etc.—General Electric dynamos were selected, the guaranteed efficiencies being:

[1]Abstract of paper read at the Nineteenth Annual Meeting of the A. S. M. E., New York, December, 1898.

Digitized by Google

	Per Cent.
At one-quarter load	84.
At one-half load	89.5
At three-quarter load	91.5
At full load	91.5

The three 75 k. w. generators, with switchboard,[1] etc., as specified, cost $5,135, or $22.80 per kilowatt. Speed, 260.

Gross cubic feet cared for per kilowatt of dynamo capacity for lighting	20,312
Gross cubic feet cared for per kilowatt of dynamo capacity for all purposes	13,541

Section D—Dynamo Engines.—The three 125 h. p. engines selected were of the Imperial compound type, built by the Weston Engine Company, of Painted Post, N. Y. Dimensions of cylinders: High pressure, 12 inches diameter; low, 20 inches; stroke, 14 inches; speed, 260. Price, $4,268, or $11.38 per indicated horse power. The same builders offered three simple engines, 15 inches by 14 inches, for the same service for $3,616, or $9.64 per indicated horse power. This should be reduced about 5 per cent. to be strictly comparable with the cost of the compounds. Computations showed that the horse power hours of service per year would be sufficient to make the fuel saving of the compound over the simple enough to warrant the additional investment.

The cost of engines and dynamos together was $9,403, which is $41.80 per kilowatt of dynamo capacity, and $25.07 per indicated horse power of engine capacity.

Gross capacity of building (cubic feet) cared for per horse power of engine, 8,125.

Section E—Wiring, Lamps, Fans, and Motors.—This work was let for $6,315, in accordance with the specifications, to the General Electric Company, their 220-volt arc lamp being selected. On the basis of 150 k. w. capacity, the price per kilowatt was $42.10, including the entire work from the switchboard to the lights and fans, exclusive of special fixtures on first floor. Adding to this two-thirds of the contract price for Sections C and D (engines and dynamos), gives the total cost of the electric lighting plant (exclusive of elevators) as $12,584, or $83.90 per kilowatt, exclusive also of boilers and piping.

Section F—Heating System.—This work was let for $6,984, including the Paul system; satisfactory plans having been submitted for reducing the amount of radiation, size of mains, etc. The number and location of radiators was the same as specified, their sizes being reduced. No other changes were made, except that the first floor radiators were supplied from basement return main, instead of from an independent main. As satisfactory performance was guaranteed with standard fittings, the requirements for long radius fittings were waived.

The following table is interesting as comparing the bids on original specifications with the contract price for the Paul system:

	As Specified.	Paul System.	Paul System with Boiler and Piping.
Radiating surface.....Square feet	24,916	18,073	18 073
Cubic feet heated per square foot radiating surface	93	128	128
" gross " " " "	122	169	169
Cost of heating plant.....dollars	7,689	6,984	16,511
" per square foot radiating surface..... "	.31	.39	.91
" " cubic foot heated..... "	.0033	.003	.0071
" " " gross..... "	.0025	.0025	.0054

It will be noticed that the radiating surface specified does not appear excessive after all, as each square foot takes care of 93 cubic feet of space heated, while each square foot under the Paul system must heat 128 cubic feet.

When a heating system is properly proportioned for hard service, with ability to heat a cold building quickly in severe weather without material back pressure, it is necessary to use ample radiating surface and piping, which, of course, mean increased first cost. In the present instance the prices indicate that the reduced surface, etc., which would do the same work under the Paul system, saved enough money to not only pay for all special apparatus, royalties, etc., but to make a considerable saving to the owners besides.

Section G—Large Pipewook and Apparatus.—This was let for $3,239, being $7.20 per unit of boiler horse power, and 18 cents per square foot of radiation contracted for.

Total Costs.—The total cost of the mechanical plant ($54,299) may be divided as follows:

Per cubic foot of gross space	$ .0178
Per cubic foot of space heated	.0234
Per square foot radiating surface contracted for	3.00
Per rated horse power of boiler capacity	120.66
Per indicated horse power of engine capacity	144.80
Per kilowatt of generator capacity	241.32

The total cost of building, including mechanical equipment, ready for the tenant's use, was $301,000, or 9.9 cents per gross cubic foot, and 13 cents per cubic foot heated. The cost named included $20,000 for the use of the party walls of the adjoining buildings, and $10,000 for Luxfer prism glass, and $9,000 for a sprinkling system. The value of the ground was $200,000, making the total investment a trifle over $500,000.

TESTS AND PERFORMANCES.

During construction and erection the work was under the supervision of the engineers, and on completion it was submitted to careful inspection and tests to determine whether the contract guarantees had been met. Since going into service the plant has been under the observation of the engineers, so that close track has been kept of its performance.

Section A—Boilers.—These were submitted to a number of evaporative trials to determine their capacity and efficiency. The details are not given here, as the methods and results are of no special interest. The boilers, however, give good service, particularly in capacity, dryness of steam and smokelessness.

Section B—Elevators.—An exhaustive detail test of capacity, speed and efficiency was made on No. 5 elevator, type "X 38," situated in the northeast shaft, and on No. 1, type "Z," located in the southwest shaft. Simultaneous readings at 2½-second intervals were taken of the voltage, speed and current—the latter being checked by two instruments, two observers reading independently. The live loads upon the platforms were obtained by weighing.

The speed of travel was calculated by dividing the revolutions of the armature by the known ratio between speed of armature and speed of car. The power consumed per trip was obtained by plotting the curves of current readings, the area of which—multiplied by the voltage—gives the watt hours per trip. This was reduced to mile of travel by multiplying the watt hours per trip by the fraction that one round trip is of one mile.

The adjustment of the starting device on the elevators was found to be for a 2½ to 3 seconds' start. This made the starting current exceed the running current by more than the 50 per cent. specified, which was based on a 5 seconds' start. When the starting devices were readjusted for a 5 second start, this condition of the specifications was practically met. It is a question of judgment, therefore, whether the tenants prefer a slow and easy start and a smooth running electric plant, or a quick start, and a correspondingly severe and sudden demand upon the dynamo and engine.

Two dynamos were operated in multiple, running both elevators and lights. With a variation of load from 250 to 600 amperes, the ordinary variation of voltage was from 220 to 226, and the maximum, 218 to 228. With a variation of load from 200 to 500 amperes, the average variation of voltage was from 216 to 220, and the maximum, 214 to 222. This variation did not affect the lights sufficiently to be noticeable, unless the observer's attention was called to it, but has been further improved by a more careful adjustment of the elevator starting devices.

It is gratifying to note that the power actually required to operate the elevator plant is considerably less than originally estimated. This is due to the use of apparatus of higher efficiency than assumed, to smaller percentage of time in motion, and to the loads contracted for being less than specified.

The data in the following table, showing the relative performance of three elevator plants in St. Louis, will be found interesting.

A and B are high pressure hydraulic plants of the most modern type, plant A having a high duty compound crank and fly-wheel pumping engine, and B an ordinary direct-acting compound pump. The Hagardine-McKittrick plant is shown in column C, and furnishing arc and incandesent lights from the same busbars. The fuel and water results are computed from the guaranteed efficiencies of boilers and engines; the elevator data, however, being based on actual test.

	A.	B.	C.
Cost of coal	$1.35	$1.50	$1.40
Water evaporated per pound coal	8.	8.	7.64
Water required per i. h. p. hour	.....	54.21	25.
Coal required per i. h. p. hour	.....	6.78	3.27
K. w. hours per car mile—average load	.....	.....	3.165

[1]The switchboard, Fig. 2, was built by the Emerson Elecric Mfg. Co., St. Louis.

Digitized by Google

H. p. hours per car mile—average load, electrical	.....	.....	4.24
H. p. hours per car mile—average load, indicated	.....	.....	5.80
Pounds coal per car mile—average load	24.	58.54	17.83
Cost of same—cents	1.62	4.39	1.21
Average i. h. p. per elevator July 12—Aug. 12, 1898	.....	.....	3.00
Cost of coal per elevator per hour—cents	.....	2.92	.69
Cost of coal per day of 10 hours—average cents	.....	29.24	6.87
Cost on basis of a round trip every 9 minutes—cents	4.13	9.75	2.75

The unfavorable showing of plant B is due almost wholly to the low duty pumping engine. The ordinary hydraulic plant using low water pressures, and ordinary duplex pumps—some times not even compounded—is still more wasteful in fuel. The favorable showing of the electric elevators is due to good counterbalancing, reduced power with loads under the maximum, and compound steam engines. The tests of kilowatt hours per car mile were made with stops and starts at terminals only. The power required will, of course, be larger when many intermediate stops are made.

Section C—Generators.—Exhaustive tests were conducted on the dynamos, covering capacity, heating, efficiency and general operation, with varying loads, both under and above rating. Very satisfactory performance was found, and complete conformance with the rigid requirements of the specification. The efficiency of the generators at various loads was computed by means of indicator diagrams and switchboard readings, using carefully calibrated instruments.

Section D—Engines.—These were tested for capacity, regulation, and general performance, and were found acceptable. The following results were secured:

Indicated horse power	126.74
Electrical horse power at switchboard	102.37
Efficiency of engine and dynamo unit—per cent	80.77
Water rate per indicated horse power hour—pounds	26.79

The latter was a trifle higher than the guarantee of 25, but the test load was a little too large, and the engine was a trifle out of adjustment. The engine efficiency was determined by a four hours' trial, measuring the water which entered the boiler, and collecting the condensation in pipe system by means of separators, drains and traps, and deducting its weight from that of the water which had been pumped through the measuring tanks.

Section E—Wiring, etc.—This section required but few tests, those made covering the points of insulation, resistance and the operation of the 220 volt enclosed arc lamps, and the accompanying mechanism, switchboard, etc., all of which was found satisfactory.

Section F—Heating System.—Tests on this part of the plant have not yet been made, as they could not be carried on successfully until cold weather. The system, however, was in use during a number of cold days in October, and its performance was satisfactory. The Paul exhausters maintained a vacuum on the exhaust line of 15 to 20 inches, and the heating was done with ½-pound back pressure, and, no doubt, could have been done with less. The circulation throughout the system was found to be complete, and all radiators hot, within twenty minutes after turning steam of ½-pound pressure into the cold system.

Section G—Large Pipework.—No special tests were required on this work, other than the observation of the actual performance of the different units in service. All were found to do their work satisfactorily.

In conclusion, it is interesting to note the actual working efficiency of the plant as compared with that of the building formerly occupied by the same tenants. There the lighting, heating and elevator service were less than half that of the new building, as were also the floor space, cubic feet and actual business transacted. The old building employed old style boilers, and furnaces, simple dynamo engines, and steam elevators. It was a corner building, however, and required but little artificial light during the day. In spite of this, however, the improved apparatus in the new plant has kept the coal consumption down to only about 25 per cent. more than in the old building, although the work done has more than doubled.

RECAPITULATION OF DATA AS TO COSTS, RATIOS, PERFORMANCE, ETC.

In using these figures, or comparing them with others, reference should be made to the explanations in the body of the paper, to determine the exact meanings.

BOILER PLANT.

Square feet heating surface per rated horse power	9.4
Ratio grate to heating surface	1 to 44.78
Cubic feet of building—gross—per rated horse power	.6771
Cubic feet of building—heated—per rated horse power	.5146
Cost of complete boiler plant, per horse power	$13.97
Cost of complete boiler plant, per square foot heating surface	1.48
Cost of ordinary boilers to do the same work, per rated horse power	11.44
Cost of ordinary boilers to do the same work, per square foot horse power	.95

ELECTRIC ELEVATOR PLANT.

Cost per gross cubic feet of building—elevators alone	$ .0072
Cost per gross cubic feet of building—elevators with engine and dynamo	.0083
Cost per square foot total floor space—elevators alone	.105
Cost per square foot total floor space—elevators with engine and dynamo	.120
Kilowatt hours required per car mile of travel	3.14 to 4.22
Average electrical horse power required per elevator	2.35

DYNAMOS AND SWITCHBOARD.

Cost per kilowatt of rate capacity	22.80
Gross cubic feet cared for per kilowatt, for lighting	20,312
Gross cubic feet cared for per kilowatt for all purposes	13,541.

STEAM ENGINES FOR DYNAMOS.

Cost of compound engines with foundations, per rated horse power	11.38
Cost per rated kilowatt of dynamo capacity	18.97
Cost of simple engines to do the same work, per rated horse power	9.64
Gross cubic feet cared for per rated horse power of engines	8,125
Water rate—pounds per indicated horse power per hour	26.79 ..
Cost of dynamos and engines per rated kilowatt of dynamos	$41.80
Cost of dynamos and engines per rated horse power of engines	25.07
Efficiency of dynamos and engines unit, per cent.	88.77

WIRING, LAMPS, FANS AND MOTORS.

Cost per kilowatt of dynamo, light capacity	$42.10
Cost including lighting, dynamos and engines	83.90

HEATING SYSTEM.

Cubic foot gross space per square foot radiating surface	169.
Cubic foot heating space per square foot radiating surface	128.
Cost per square foot radiating surface	.39
Cost with boilers and piping	.91
Cost per cubic foot gross space	.003
Cost with boilers and piping	.0071
Cost per cubic foot heated space	.0023
Cost with boilers and piping	.0054

LARGE PIPEWORK AND APPARATUS.

Cost per rated boiler horse power	7.20
Cost per square foot of radiating surface	.18

COMPLETE MECHANICAL PLANT.

Cost per cubic foot of gross, space	.0178
Cost per cubic foot of space heated	.0234
Cost per cubic foot radiating surface contracted for	3.00
Cost per rated horse power of boiler capacity	120.66
Cost of indicated horse power of engine capacity.	144.80
Cost per kilowatt of generator capacity	241.32

COMPLETED BUILDING.

Cubic feet of space, gross	3,046,727.
Cubic feet of space heated	2,315,612.
Square feet of floor space	210,116.
Cost of building per cubic foot gross	$, .099
Cost of building per cubic foot heated	.130

Digitized by Google

Incandescent Lamps and Welsbachs.

Mr. Edward Backus, Supt. of Light, at Somerville, Mass., has recently made the following interesting and curious report:

"I have been requested by his honor the Mayor to make a test of the Welsbach and 32 candle power incandescent lamps to ascertain which was best adapted to street lighting. Now, the test of these lights is not which gives us the greatest candle power, but which gives us the best lighted streets. We know the Welsbach claim a light of 64 or more candle power and the incandescent of 32, so that a photometric test for candle power would result largely in favor of the Welsbach. This is not the test that would demonstrate the relative advantage of one light for another for street service. It is a well-known scientific fact that what is known as the red ray in light has a much greater penetrating quality than any other ray. The incandescent is very rich in this, while the Welsbach has a small percentage of the same, and although the Welsbach gives appa.ently a very bright light, its penetrating qualities are comparatively poor. One test which I have applied, and a very simple one, which any of you can try, is, to take an ordinary sheet of white paper, with a line drawn across it in ink, and cover the same with three or four sheets of thin brown paper and try the distance away from a Welsbach light this line can be distinguished when looking through a tube, and then apply the same test to a 32 lamp. The result of this test shows four incandescent lamps, 57, 45, 60 and 63, making an average of 56¼ feet for each light. Two of the Welsbachs, burning Cambridge gas, showed at 51 and 42 feet, and two, burning Charlestown gas, showed at 42 and 57 feet, making an average of 43 feet. Another test tried was to stand equi-distant from each kind of light and hold a pencil upright on a level surface. If both lights were equal the two shadows would be of equal density. In the actual test the shadows appeared the same at a point 3 feet nearer the Welsbach than the incandescent, and, from the tests shown, the 32 candle power incandescent has the greater penetrating power, and, in my opinion, is best adapted for lighting our streets."

Polarization of Electric Radiation.

PROF. CHUNDER BOSE, says the "Electrical Review," London, described in a paper read before the Royal Society last March, experiments on the polarization of electric radiation by lamellated and fibrous structures. He had shown in a previous communication that a pair of books may be conveniently used as a polarizer and analyzer, the layers of leaves transmitting only radiations polarized in their own plane. In this paper further details are given of the construction and use of a convenient polariscope on these lines. He had previously found that a bundle of parallel fibers, such as jute, held at an angle of 45° with the direction of radiation, produces double refraction, the velocity of propagation in planes parallel to the fibers being different from that in planes at right angles to them. If the bundle be placed so that its fibers are parallel to the direction of radiation no effect is produced. He now shows that if the last bundle be twisted, forming such a structure as a piece of spun yarn, the plane of polarization is rotated, the direction of rotation changing with the sense of the twist. Such a bundle has no polarity, its properties are identical at the two ends, it may be reversed in direction without affecting its action, and similar bundles in all possible directions will produce rotation in the same sense. Space through which the radiation is being transmitted may be filled with such bundles, and their action will be additive. If the radiation after passing through a space filled with such bundles were reflected so as to return through them, the plane of polarization in the second passage would be rotated through the same angle as in the first passage, but in the opposite sense, so that it would finally emerge polarized in the same plane as that in which it entered. If the radiation passes through two equal bundles twisted in opposite senses, the two neutralize one another's actions, and the plane emerges as it entered. So if the space be filled with bundles, one-half twisted in one sense-the other half in the other, the resultant action will be nil. Prof. Bose clearly distinguished between the two cases in which rotation of the plane occurs. (1) The rotation induced by a magnetic field; this rotation among other things is dependent on the direction and intensity of the magnetic field, and is doubled when the ray is reflected back. (2) The rotation produced by saccharine and other solutions, when the rotation is equal in all directions and simply proportional to the quantity of active substance traversed by the ray. The rotation in this case is neutralized when the ray is reflected back. It is not difficult to see how the first effect can be produced on the sort of hypothesis used by Prof. Poynting to explain the Zeeman effect, and by Prof. Fleming to explain the magnetization of iron; but Prof. Bose has been, we believe, the first to suggest a mechanism which might produce the second effect. This mode of attacking the problem of the fine constitution of matter in relation to light, by means of coarse structures and radiations of comparatively long wave length, promises further interesting results.

Duration of Röntgen Ray Emission.

Roiti, Trouton and Colardeau have by various means endeavored to ascertain the duration of a single X-ray impulse. The values arrived at varied from 1-300th to 1-10,000th of a second. H. Morize has devised and carried out a method of determining this duration, which he believes to be capable of great accuracy. A photographic plate is fixed on the end of the shaft of a high-speed motor. A metallic slit is mounted in a radial direction just in front of the plate. Photographs are taken when the motor is at rest and when it is moving at a known speed. The images of the slit appear drawn out sideways when the plate moves, and the amount of the broadening is a measure of the duration of the X-ray impulse. The results obtained by this method show that to each current impulse in the primary of the induction coil there correspond several successive impulses of the rays. Successive images of decreasing intensity are thus produced, separated by uniform intervals. On some plates four images can be traced, the last being very feeble. The durations obtained ranged from 65 to 107 millionths of a second, with a mean of 82×10^{-6}. The intervals were 0.00033 sec. on the average.—Morize, Comptes Rendus, Oct. 17, 1898.

Vacuum Tubes vs. Coherers.

A. Righi appears at last to have invented a vacuum tube which is capable of seriously rivaling the coherer as an electric wave indicator. The details of its construction are not given, the reason being that they are "too complex," but the tube has the peculiarity of showing a continuous streak of light between the two electrodes, which breaks up under the influence of electric waves into the accustomed succession of positive strata, dark space, and cathode light. The cathode is a wire, and the anode a disc, and under ordinary circumstances a cone of light extends from one to the other. This condition is resumed after the electric radiation has ceased. The curious thing is that the effect is produced also when the radiation impinges upon some portion of the circuit of the vacuum tube not too far away from the tube. Hence it is probable that the influence of the radiation does not affect the gas in the tube, but only the electrodes. But besides the optical phenomenon, which is in itself a valuable indicator of the presence of electric waves, there is a change of resistance, as in the coherer, which is indicated by a galvanometer. Often, the current is increased to three times its original strength when the tube lights up, and that effect might, of course, be multiplied indefinitely by suitable relays. The advantage of not requiring a special mechanism for restoring the original resistance is obvious, but, on the other hand, Righi does not seem to have experimented with transmissions longer than seven yards.—Righi, Nuovo Cimento, July, 1898.

Difference Between Röntgen and Cathode Rays.

The argument for the essential identity of cathode and Röntgen rays is based upon the fact that there are various kinds of cathode rays, which, as regards deflectibility and penetrating power, may be arranged in a continuous series. In this series the Röntgen rays obtain an extreme place at the end, where the deflectibility is zero and the absorption by solids a minimum. A difficulty occurs at once, through the fact of luminous rays being undeflected and Hertzian waves being unabsorbed under somewhat similar circumstances, which makes the classification

Digitized by Google

of Röntgen rays among cathode rays appear artificial. J. Von Geitler attempts to bring out clearly the essential difference between the two classes of rays by a study of their electrification or ionization properties. He quotes a number of experiments to show that Röntgen rays are absolutely incapable of conveying a charge. They can equalize opposite charges, by rendering the air between them conducting, but they cannot, like cathode rays, convey an electric charge into the interior of a closed metallic vessel connected to earth or out of such a vessel into the open air. All this speaks in favor of regarding the Röntgen rays as essentially different from cathode rays, and this desideratum is fulfilled by both the new theories of Röntgen rays now before the public, the English wave theory, in which cathode particles when stopped generate single-wave impulses, and the Dutch corpuscular theory which regards Röntgen rays as discharged cathode particles.—Geitler, Wied. Ann., No. 9, 1898.

Currents Generated by Röntgen Rays.

IN 1897 Perrin succeeded in obtaining differences of potential between two different metals when exposed to X-rays, and even observed a small constant current of about 10^{-8} amperes on joining them by a wire. A. Winkelmann has made further observations on this interesting subject. He placed a Röntgen apparatus in a leaden box with an aluminum window. In front of the window he mounted an aluminum plate, and behind that a copper plate. On working the apparatus and connecting the two through a galvanometer, a small current was indicated, which was increased by reducing the distance between the plates. A battery of plates could be constructed by mounting plates of the two metals alternately one behind the other, taking care, however, that the insulator between them was not, like mica, for instance, impervious to X-rays. The resistance of one such battery was found to be 130 million ohms, and to increase as the battery was moved away from the Röntgen apparatus, evidently owing to the lesser degree of ionisation of the more distant air. Further, the resistance of the layer of ionised air diminished as the thickness of the layer was diminished, down to a certain minimum. At very small thicknesses the recombination of the ions is so rapid that the current intensity is thereby diminished. The author calculates the proportion of ionised molecules of air in the total number of molecules at 4.6×10^{-18} at least, in a position of maximum conductivity.—Winkelmann, Wied. Ann., Nov. 9, 1898.

MICHAEL FARADAY; HIS LIFE AND WORK. By Prof. S. P. Thompson, D. Sc., F. R. S., New York, 1898, Macmillan & Co. Cloth, 12mo., illus., 308 pages. Price $1.25.

Strange as it may seem, this is the only book now obtainable by the public that tells the story of Faraday's simple career and tremendous discoveries. There are one or two other biographies, out of reach chiefly because they are out of print, but whatever their value and charm, this in no wise falls below them. The author writes with enthusiasm, but is not a blind lover of his hero; he is himself a skilled experimenter and scientist, and therefore touches luminously each real point of importance; while to the plain and unpretending story of a beautifully sincere but prosaic life he brings literary ability of the highest order. Indeed, it must be said that Prof. Thompson has once again written a fascinating book. The task was not easy, for the work of the father of the dynamo and motor, stretching across half the century, is not always susceptible of broadly popular explanation; but what can be done has been done. As one follows the story of investigation through these pages, the idea of electromagnetic rotation can be felt growing in Faraday's mind, and his subtle "field of force" is seen like every great sweeping fundamental principle, subduing all things to itself. A man who has grasped truths like these will go a long way. Sometimes he has to wait for recognition; happily for Faraday and for this age, the popular perception of the value of his discoveries was well nigh instantaneous. With him the Age of Electricity, not for the philosopher, but for mankind, began.

The chapters that relate to Faraday's personal life are all too brief, but Prof. Thompson, with a quick eye for incident and color, makes the most of the happenings in a career that was one of splendid poverty. The man's love for his wife, the sacrifice of professional emolument, his sternly quaint religious beliefs, his attachment to the Royal Institution, his pride in early deftness as a bookbinder, his shortness of memory, the glorious lectures, his secret charities, his tilt with the spiritualists, his work for the lighthouse authorities, his appreciation of others' ideas and inventions—all this and much more is told succinctly but delightfully. The book belongs to the Century Science Series, to which it is an admirable addition; and it is adorned with a clever portrait of the immortal successor to Davy and friend of Tyndall and Kelvin.

HANDBOOK OF CORLISS STEAM ENGINES. By F. W. Shillitto, Jr. Published by the American Industrial Publishing Co., Bridgeport, Conn. 1898. 224 pages. Price, $1, $1.50 and $2, according to binding.

This splendid elementary treatise on the Corliss engine has been prepared by the author with the view of giving the practical man in the engine room as well as the student of engineering a good working knowledge of the Corliss engine and how to manage and take care of it. It has been the aim of the author to set forth the principles governing the subject matter in language free from unnecessary technicalities and as concisely as possible. A few indicator diagrams have also been introduced for the purpose of illustrating certain points. The book contains chapters on foundation, lining and leveling and assembling of the moving parts. Part II. of the book contains chapters on valves and valve gear, dash pots, eccentric rods, centering the engine, setting the eccentric and governor, tables and memoranda. Then follow nine chapters on as many types of Corliss engines, all of which must prove of great interest to engine room attendants and engineers. The book is well printed, illustrated and bound, and contains a very complete index.

ELECTRICAL TRANSMISSION OF ENERGY. By Arthur Vaughan Abbott, C. E., New York, 1898, D. Van Nostrand Co. Cloth, 8vo. 585 pages. Illus., and folding plates. Price $4.50.

This is the second edition of Mr. Abbott's invaluable book, which, published some two years ago, has witnessed an extraordinary development in some of the fields that were barely opened in 1895. As the author remarks, there is little new to add in the way of invention, but there has been much to add in the way of tested theory, solid experience, and the record of instructive work. On what may be called its practical side, the work has therefore received a great deal of thorough and careful revision, and more than ever we can now recommend it to all who wish to make themselves acquainted with the subject or masters of some of its branches and details. We hope that Mr. Abbott will continue his analysis of the various problems, and venture to suggest that a useful addition to the next edition would be the actual records of financial results of some of the transmission enterprises, both large and small; an extension, in fact, of the last chapter.

The Purdue Exponent.

Volume X, No. 9, of the Purdue Exponent, a very creditable publication issued by the students of Purdue University, Lafayette, Ind., and devoted to art, literature, music, science, engineering, etc., has just been received, and as it is the electrical number, it is of special interest and significance to our readers. It contains good articles on the following subjects, all of which are well and uniquely illustrated: Physics in electrical engineering, the dynamo laboratory, the uses of the storage battery, what is an electrician, the illumination of a monument, electric transportation, the electrical society, the commercial aspects of electrical engineering, the training of an electrical engineer, wireless telegraphy, long-distance transmission of power, and lightning arresters. The articles which were, we understand, prepared by the students or graduates of the university, speak well for the excellent training they receive at the hands of Prof. W. Elwell Goldsborough and his assistants. The students, as well as the professor, are to be congratulated on this admirable production.

Digitized by Google

THE

ELECTRICAL ENGINEER

[INCORPORATED.]

PUBLISHED EVERY THURSDAY.

120 LIBERTY STREET, NEW YORK.

Telephone: 1323 Cortlandt. Cable Address: LENGINEER.

T. COMMERFORD MARTIN AND JOSEPH WETZLER, Editors.
MAX LOEWENTHAL, Assoc. Editor.

A. C. SHAW, Secy. and Business Manager.

CHICAGO OFFICE, - - - - - - 700 Fisher Building.
PHILADELPHIA OFFICE, - - - - - - 1100 Betz Building.

Terms of Subscription.

United States, Canada and Mexico,	per year,	$3.00
Four or more Copies in Clubs (each)	"	2.50
Great Britain and other Foreign Countries within the Postal Union,	"	5.00
Single Copies,	"	.10

[Entered as second-class matter at the New York Post Office, April 3, 1888.]

Vol. XXVI. NEW YORK, DECEMBER 29, 1898. No. 556.

Electric Versus Cable Traction.

A FEW weeks ago, soon after their publication, we commented on and expressed satisfaction over the results achieved by the Metropolitan Street Railway Company, of this city, results practically sealing the doom of horse car traction, relegating the cable to second or third place, and proving, regardless of its great cost of installation, the many advantages of the underground conduit. We warned our readers, however, that in the use of the figures for comparison it must be borne in mind that they represent results achieved during a time of reconstruction, that they cover but a short period of existence of the electric lines and especially that the conditions governing the adoption of the system in a city built and populated like New York, must be taken into consideration. That this latter is an important and perhaps a governing factor is shown by the fact that the Metropolitan Company themselves are contemplating the installation of a compressed air system on one of their crosstown lines.

Regardless of the above warning and that expressed by Mr. Vreeland himself, when he kindly permitted the publication of the report for the intelligent use and guidance of street railway men and investors, some very absurd and unintelligent use has been made of the figures. We all know the flexibility of figures and tables, and that if expressed in words their translation may easily be made to represent the views of the translator. One of these unqualified uses of the figures was recently made by Mr. Arthur J. Wood, in a paper entitled "Some Notes on Light Railroads," read before the students of the Stevens Institute of Technology, under the heading of "Street Railway Costs." He therein compares the electric and cable systems of New York with those of Chicago, and reaches the conclusion that the cable will seldom be replaced by electricity because of an estimated decrease in the working expenses. And this in face of the figures given by President Vreeland, showing that the cost per car mile of the electric conduit system in New York is only 10.23 cents against 16.35 cents for the cable, and his statement that within a short time this figure for the conduit would be considerably reduced on account of better generating and operating facilities. These figures apparently do not appeal as strongly to Mr. Wood as those alleged to represent the Chicago record, where the trolley costs 13.051 cents per car mile to operate and the cable only 10.706 cents. All these figures go to prove that the electric conduit costs less to operate per car mile than the overhead trolley or cable, whether the cost of the latter be computed in New York or Chicago. It does seem strange, however, that they find in the latter city that the "maintenance of way" account for trolley and cable is about the same, while in New York it is ten times more for the cable than for the conduit, which is easily explained when one considers that the items for renewals of cable, wages of oilers, gearmen and splices, amount in the aggregate to 2.10 cents per car mile. In fact, according to President Vreeland, "the renewals of cables alone cost much more per car mile than will be the entire cost of electric power under final conditions." Would it not be pertinent to ask what kind of cables they use in Chicago, where the "maintenance of way" item, which includes the costs for the maintenance of buildings only amounts to 1.278 cents? And how is it that this item for the cable roads is nearly three times as much in New York as it is in Chicago, considering that the traffic on the cable lines was heavier in Chicago than in New York? And still the transportation item for the same roads is nearly twice as large in New York. Strange figures or perhaps a still stranger compilation.

Other figures compiled from European as well as American practice are cited, but the author, disregarding the results achieved in New York, concludes that "the cost of working the cars by the three methods (trolley, conduit electric and cable), should not vary widely. There are demands of the people which must be satisfied, and the question of cost should be subordinate to these." We agree perfectly with Mr. Wood and are glad to see one system so admirably fulfilling both conditions, namely, those of convenience of travel and small cost of operation. And that system will surely triumph in the end.

Municipal Conservatism in England.

IT is well known that at last there is a stirring up of the municipal authorities in England on the subject of electric traction. All over Great Britain steps are at last being taken to come abreast of the times, and London, Liverpool, Leeds, Belfast, Cork, Nottingham, Norwich, Hull, Coventry and Sheffield, are following the initiative of Dublin, Dover and Middlesboro. One of the reasons for the long delay has been that no temptation was offered private companies to invest their money in electricity and that the municipalities themselves were not ready.

A striking example of the general situation in England is furnished by Manchester, where all the existing franchises within city limits will have expired by 1901, and where electric traction is now to be substituted by the municipality itself, both in the city and in adjoining Salford. The private companies will simply disappear from the streets and the municipal service reign supreme. This is all very well, but right here crops out the inevitable failure of a municipality spending its own money to get the latest thing going or next to be. The English correspondent of the New York "Tribune" says: "The members of the Manchester Town Council are rigid economists. They are subjected to criticism for favoring an unsightly system when a superior one is in operation in New York and elsewhere, but they have counted the cost of laying conduits in Market street, and throughout the city, and have been frightened by the aggregate. They assert that before the concrete trenches could be formed all gas and water pipes, hydraulic mains, sewers and telephone and electric light wires would have to be removed to a lower level; that many of the streets would have to be resewered; that the present tram rails would have to be thrown away, and that wherever the lines cross one another each roadway would have to be excavated and culverted and carried on massive brick piers or iron girders. The streets would have to be reconstructed at enormous expense and prolonged public inconvenience. Consequently the Tramways Committee has rejected the conduit system, and is preparing to put up overhead wires."

This is all very well, but we undertake to say without fear of contradiction that had the city fathers left the enterprise to private energy and capital, they would have been immovably flatfooted in their insistence on the conduit as demonstrated in New York or Buda Pest.

We do not say that the Manchester authorities are not wise in their prudence, but it is just these things that warrant the existence of street lighting and street railway companies, but for which the world never would have had either electric lights or electric railroads. Attracted by the prospect of large reward, private capital is devoted to the development and perfection of these new ideas, and that is the only way yet known of hammering out the inventions and advances of genius into the shape that makes them available to everybody. The Manchester corporation is not doing one single solitary thing to help the new arts along. On the contrary, by adopting a method which, with all its great merits, leans to the past rather than looks to the

Digitized by Google

future, the authorities there have as usual choked down the spirit of improvement. A private company could have been given many inducements, and would in return have shared profits with the city far beyond anything the city will ever earn for itself.

Bears and Horses.

CONSIDERABLE amusement has been furnished throughout the country, it would appear, by the gift of a young bear to the New York Zoological Society for its bear pit, by the Engineers' Club. The facts of the case are simple enough, the gift being merely a graceful recognition upon the part of the Club of a charming lecture on big game from a famous hunter and naturalist who is interested in the success of the new Zoo. But this has not hindered the expenditure of a large amount of journalistic ingenuity in seeking for some deeper esoteric significance or in suggesting more or less recondite resemblances between bears and engineers. These friends of the lay press forget that if the engineers had been looking for a typical animal they would probably have taken a beaver.

It is pleasant to note the happy relationship existing between the engineers and the naturalists, as evidenced by this incident which would suggest an easy way for the Zoological Society to fill its preserves, each kindred or technical association contributing an animal. We should be glad to see the electrical engineers, for example, presenting a horse. They are now doing the best they can to render the horse an extinct species, and it is well to look after the preservation of a choice specimen or two, betimes.

Fifty or a hundred years hence this proposition may not seem extravagant, and even at the present moment we venture to raise the question whether the restriction of horses in cities to the limits of zoological gardens is not a work to which all engineers might address themselves with assiduity. The horse is too much with us. The pig and the cow have been banished from modern cities; even the goat has but a precarious foothold on their outskirts. We fail to see in what sanitary respect the horse is more desirable or respectable. Dogs and cats are as bad, but they can be trained in some of the decencies of life, and it cannot be said that their stables lower the value of all the property in the vicinity by making it malodorous and unhealthy. Nothing but the necessities of the case has warranted the existence of horse stables all over a city in closest proximity to human dwellings; and now that the automobile has arrived, the movement should at once be started to banish every horse from city limits, within which they have been tolerated altogether too long.

The exclusion of thousands of horses from a city has nothing whatever to do with the enjoyment of various sports in which they are employed. That is quite another matter. The point is that it is better for public health, better for the streets, and better for the animals themselves, that horses should be debarred from city life, and that the transition to horseless vehicles of all kinds should come quickly. The swift success of the power street car, least lovely of all its kind, shows how inevitable the change is. Nobody would welcome back the horrible car stables or the conditions of rough paving, the ammoniacal odors, the flying debris of excreta in the eye and nostril of the public, that went with those days. Just so will our successors wonder how this generation could call itself civilized while permitting work to be done for it by offensive animals when competent mechanism awaited the command to do it all.

More than that, the appeal on the side of the animals is as strong wellnight as that for the sanitary welfare of human beings. The stench of Madison Square Garden in Horse Show week is ghastly, but the suffering of many of the poor beasts there is worse. In summer, along the streets, it is pitiful to see the horses enduring the heat; while at any season of the year, a bicyclist making the circuit of the city cannot fail to note instances daily of horses compelled to undue effort under the stress of pain brutally inflicted. As to what becomes of the horses when past duty, the complaint may be cited from the London "Lancet" that the traffic in old horses as at present carried on is a disgrace to England. They are treated cruelly and, whether sound or diseased, are sent abroad to be used as food. The Board of Agriculture has now issued an order, to take effect with the new year, making it unlawful to convey from any port in the British Isles, to any place outside the British Isles, any horse which, owing to age, infirmity, illness, fatigue, or any other reason, cannot be so conveyed without cruelty during the intended passage and on landing." Yet every Englishman dearly loves a horse!

It will be something to have supplanted the horse stages on New York's Fifth avenue by electric automobiles, but the good work for a clean and healthy city will not be ended until it is an offense to keep or drive a horse within the same limits from which other animals just as useful to man have already been expelled. Then, too, Humane Societies will have lost their function, and cabs will be within the reach of every purse.

Lack of Engineer Troops.

THERE was a very important statement made by General Miles the other day when before the War Investigating Committee. To sum it up, he attributed much if not most of the trouble experienced in the late war to the "lack of engineer troops." Engineers have been thinking a good deal over that very fact for some time past. We are all familiar with the heroic efforts made by Col. Griffin to supply part of the deficiency, and it seems high time that attention were paid to his ideas and suggestions on the subject. Whether it be a torpedo militia or other body, the army needs this special kind of engineering infusion or addition seriously, and as Col. Griffin has said, we could not face the chances involved in another war without thus reinforcing that arm of the service.

As to the needs and conditions in the navy, there is given an admirable survey of the subject in our columns this week, by Mr. F. W. Roller, who discusses the question of personnel just as he and Mr. W. D. Weaver have already discussed the questions of material. At this juncture, when the unification of the line and engineer branches is up before Congress, Mr. Roller's thoughtful and cogent review of the case must do much to bring reforms that are highly necessary. Now is the time to apply these lessons of the war, while the memory of what was suffered or was amiss is still fresh with everybody.

EDUCATIONAL

More Gifts to McGill University.

Reference was made in these pages last week to the fact that Mr. W. C. McDonald has given about $2,000,000 to McGill University. Since then, at a meeting of the Board of Governors, Lord Strathcona gave $780,000 in further endowment of the affiliated Royal Victoria College; the Board gave $186,000 to cover various deficiencies, and Mr. McDonald gave $50,000 towards endowing a history chair, thus bringing his gifts up to the sum, it appears, of $2,305,069.

LEGAL NOTES

Tesla Polyphase Patents Declared Invalid in Germany.

The Reichsgericht of Germany has confirmed the decision of the lower courts declaring the Tesla polyphase motor patents invalid. The court reviewing the case, holds that the patents are void owing to their not having been worked according to the requirements of the German patent law. The court goes on to say, however, that even if the patent had been sustained on that ground, it would have been, nevertheless, invalidated owing to the fact that the invention was not adequately described in the German patent specification, whereas the American patent specification is clear. It is understood that the Helios Co., of Cologne, who control the Tesla patents in Germany, will no longer contest the suits which it has brought against several parties in Germany.

Digitized by Google

TELEPHONY AND TELEGRAPHY

The Fleming Plan for Imperial Cables.

SIR SANFORD FLEMING of Ottawa recently addressed a letter to Hon. Joseph Chamberlain on the subject of a State-owned system of electric cables for the British empire, to circle the earth. The Pacific cable, he says, would serve the purpose of trade between Australasia and Canada, but these countries are debarred from establishing telegraphic connection with Hong Kong by an agreement with the Eastern Extension Telegraph Company, excluding Canada and the southern colonies from that port. Sir Sanford admits that the proposal for the establishment of a Pacific cable would undoubtedly interfere with the rich monopoly of the Eastern Extension Company, but he holds that no private company should be allowed to stand in the way when great imperial interests are at stake. He lays it down as essential to the imperial cable service that none of the lines should touch foreign soil, and that they shall be placed so as to avoid shallow seas, more especially those seas in proximity to any country likely at any time to prove unfriendly. He thus describes the imperial telegraphic circuit of the globe: Commencing at Vancouver, the cable would cross the Pacific to New Zealand and Australia; from Australia the main line would cross the Indian Ocean to South Africa; from South Africa it would traverse the Atlantic to Canada, where it would connect with the transatlantic lines. Such a system would constitute a base for connecting every one of Her Majesty's possessions and naval coaling stations (Gibraltar and Malta excepted) by the most perfect means of conveying intelligence at disposal. The cable from Vancouver would first find a midocean station at Fanning Island, a second at Fiji Islands, a third at Norfolk Island; at Norfolk Island it would bifurcate, one branch extending to New Zealand, the other to the eastern coast of Australia. From King George's Sound, or other point in Western Australia, the cable would extend to Cocos Island, thence to Mauritius, and thence to Natal and Cape Town, as may be found expedient. Cocos would become an important telegraphic centre, and it would be a convenient point for connecting Singapore by a branch cable. Singapore is already in connection with Hong Kong by an all-British cable via Labuan, and Her Majesty's Government can take possession by giving a twelve months' notice to the Eastern Extension Company. India could be reached by a branch from Cocos to Colombo or Trincomalee, in Ceylon. At Mauritius a connection would be formed with the existing cable to Seychelles, Aden and Bombay. In order to avoid the shallow seas along the west coasts of Africa, Spain, Portugal and France, it is proposed that a cable should extend from Cape Town to Bermuda, touching at St. Helena, Ascension and Barbados as midocean stations. At Bermuda a connection would be formed with the existing cable to Halifax, and at that point with the Canadian and transatlantic lines. Sir Sanford Fleming approximates the distances which each group of cables would require to cover as follows: Pacific Ocean, 7,150 knots; Indian Ocean, 9,100; Atlantic Ocean, 6,600; total, 22,850. He estimates the cost at between £5,000,000 and £6,000,000. He further says: "I have long advocated the first division of the proposal—the establishment of a cable from Canada to Australasia—as a State work. I have felt that it would be the forerunner of an all-British telegraph system embracing the whole empire. As a State undertaking, I am satisfied that the Pacific cable would be a complete commercial success, and that so soon as it so proved the cable extension to South Africa and India would follow. That a State-owned Pacific cable is the key to the situation I am firmly convinced."

What the Bell Telephone Co. Owns.

The New York "Herald" has made the important discovery that the Amerian Bell Telephone Company owns 67 per cent. of the stock of all the telephone exchanges of the country. The next thing we hear may be that the Vanderbilts have obtained control of the New York Central railroad system. It is the season of surprises in the New York newspaper offices.—Hartford Times.

Telephone "Alarm Clocks" at McKeesport, Pa.

McKeesport and environs are inhabited by hundreds of mill men. These do not always have regular hours to go to work, but are awakened all hours of the day and night, whenever a heat is ready or a shift goes off. The mill men had to make sure of being awakened at the proper hour, and, owing to the uncertainty of the working hours, alarm clocks were useless.

Boys and watchmen were employed to go from house to house calling the men needed on the turn, and these would stand rapping at the door or shouting at the windows until answered by the sleeper. Many complaints were made of the noise which frequently awakened scores of people in the neighborhood who did not want to rise early.

The low price of telephones settled the difficulty. The rival telephone companies canvassed the workmen who had to be awakened, and these put in telephones at the rate of a dollar a month, and the companies awakened the sleepers. The operator at the telephone central is called up by the mill superintendent or his clerk, who specifies the men to be awakened.

The operator commences a series of ringings, until all the men on the turn have answered. Instructions are given not to cease ringing until a sleepy "hello" comes from the other end of the line so that the operator is sure the toiler is up. The mill superintendent also finds it convenient, as sick men who cannot go on duty, report by telephone, thus giving the bosses time to secure additional help.

Independent Telephone Lines in the West.

A special dispatch from Boston says: The system of toll lines which has been built in the Northwest by the Western Electric Telephone Co. has been so successful, that people identified with the above company have recently purchased the charter of the Standard Telephone Co. in Missouri, and are building a system of toll lines in that section of the country in opposition to the Bell Co. Ex-Governor Thomas F. Crittenden is president of the new Standard Telephone Co. and Charles Webster vice-president and general manager. The company's capital is $300,000, of which between $150,000 and $180,000 has been issued. The capital is issued as the lines are built. Up to the present time 980 miles of lines have been completed and material for 80 additional miles is on the ground. The new company has started in to build a trunk line from Kansas City to St. Louis, connecting independent exhanges in those cities. It is proposed to build 1,250 miles of line, of which one-third will parallel Bell Telephone lines. The construction is similar to that in the Northwest, 35-foot poles in the city, 25 in the country, 25 to 30 poles to the mile. Nos. 9 and 10 iron wire are used.

The Ries Telephone System.

Mr. Elias E. Ries, a well known electrical inventor, is the inventor of an automatic telephone, the main features claimed for which are many improvements over existing instruments and a cut of one-half the present cost. The directors of the corporation, which has lately filed its papers at Albany, are Mr. Ries, Israel Steinhart, H. A. J. Wilkens, Martin Lowenstein and Henry J. Furlong, of Furlong & O'Connell, counsel for the company. The capital stock is $1,000,000, the majority of which, Mr. Ries says, has been subscribed. The company has offices in the New York Life Building. The corporation will organize branch companies in every State in the Union, in direct competition with the Bell system.

The new telephone has been on exhibition at the corporation's offices. It transmits with great clearness. The saving in cost, Mr. Ries says, is effected in two ways; the magneto bells in each subscriber's box are done away with, and the work at the central office is performed much more swiftly and easily.

The receiver of the new apparatus is a sealed chamber, which may lie about on one's desk anywhere. It is so weighted as to stand upright. The connections in the receiver are made through a mercury cup. When the receiver is in an upright position the mercury lies in contact with a tip of iron, and by this connection the "talking" circuit is established. A button in the receiver's top is used instead of a crank for calling central. The current comes from a single generator in the central office, which can serve any number of subscribers, thus doing away with the magneto bell in each subscriber's separate box. This central generator, to supply 5,000 customers, would cost

Digitized by Google

about $100, Mr. Ries estimates, as against a cost of $5 to put in each magneto bell.

When the subscriber has rung up central he lifts the receiver to his ear, reversing its position. The mercury flows to another part of the receiver, making the "hearing" circuit. If while in this position he wants to attract central's attention he merely tips his receiver over and presses his button, and the bell rings in the central office. A bell also rings in his transmitter's box, but it is not a magneto bell. The power to ring it comes from the central generator.

While the subscriber is talking the receiver being in a reversed condition, no one can cut in on him by ringing his bell, and even if three or four different subscribers use the same wire none of them can hear conversation except from the man he has called up. The subscriber is not bothered by the question "Are you through?" When he is through he simply lays down the receiver.

Competitive Telephony for Cincinnati, O.

An independent telephone company, called the Tristate Telephone and Telegraph Company is seeking a franchise in Cincinnati. Philadelphia capitalists are said to be behind the venture. The matter became known through W. W. Granger, B. of L. member from the Second Ward, introducing an ordinance in that board about a week ago to give the new company a franchise.

The ordinance provides for subways and poles to string wires. The ordinance was referred to the committee on telephones and telegraphs.

In this connection Captain George N. Stone, of the City and Suburban Telephone Company, said: "A telephone company must necessarily be a monopoly to give satisfactory service, for if there are two or more companies all telephone users who depend largely upon the telephone must have as many telephones as there are companies in order to reach all telephone subscribers. Instead of reducing the rates, they will be increased and the service will be complicated and inefficient. For example: If two other companies are organized in this city, and each company takes 2,000 of our 6,000 subscribers, leaving us 2,000, and all three companies agree to make a rate of $50 per annum, it would result in each subscriber having three telephones on his wall at a cost of $150 per annum, instead of having a perfect telephone service such as we are now rendering to business houses as low as $60 per annum, and to residences as low as $30 per annum, with a maximum rate of $100 and $80."

Electric Power Companies and Their Relation to Municipalities.[1]

A. E. LANG.
President American Street Railway Association.

CONSIDERATION of the relation on the part of an electric power company to the station producing the current, on the one hand, and to the community consuming it on the other, opens a field of thought and discussion quite beyond the possible limits of a single paper.

I must, therefore, touch but briefly the outlines of this field, with the hope of thereby suggesting questions that will bring out an interchange of view along practical lines.

There is a twofold object which must be accomplished. First, the investment of capital must be made profitable to the investors, and second, the community must be served in the best possible manner at a minimum cost.

No new or improved electrical equipment of either street railway or light company makes its appearance that the community does not demand and the enterprising manager desire to supply. If the company does not respond, the community then demands that they give way to some other company who will do so. Failing in this, the cry goes up for municipal ownership.

The community gives little thought to the financial condition of electric or even other quasi-public corporations, but is ever demanding more—more. This is American, and we are put on our mettle to meet these conditions. Now, how shall they be met? The fact remains, and must be recognized, that there exists a growing distrust of corporations. The question is: What has brought this about? Who is responsible for it? Can the condition be changed and bettered, and, if so, how?

Let us look at it first from the point of view of the corporation, and as the experience of one is largely the experience of all. I will tell you something of conditions regulating corporations in Ohio, and also something of the company and plant which I represent.

It will, of course, be understood that power plants are not brought into existence until preliminary arrangements are made for their operation in carrying on the street railway or electric light business. For this purpose corporations are generally formed under the laws of the State where the business is to be transacted. The laws of the State of Ohio authorize any five persons resident within the State to incorporate by setting forth the name they desire to assume, the kind of business to be pursued, the county in which the business is to be conducted, and the amount of capital stock it is expected to employ.

If the incorporation is allowed, a certain percentage of the capital stock must be subscribed, and a certain percentage paid in, after which, by following given forms as to opening books of subscription, giving notice, etc., the stockholders may organize, elect officers, who must qualify under oath, and then they may proceed to transact business.

Such corporations may acquire the necessary real or personal property rights and franchises, make contracts, sue and be sued, etc. They may also issue bonds, not exceeding the amount of their capital stock, and mortgage their property to secure the payment of the same.

Municipalities in our State are authorized to enter into contracts with corporations thus formed, granting the use of streets for laying down and maintaining tracks, and for the erection of necessary poles and wires for their operation, and also for the erection of poles and wires, and the laying of conduits, for the operation of electric light and power companies.

Street railway companies are first required to procure the consent of the owners of the majority of the feet of the lots and lands fronting upon each street sought to be used. Bids are then invited as to the price to be charged for carrying passengers, and the grant is then awarded to the person or company agreeing to carry passengers at the lowest rate of fare.

When this is determined and the other terms and conditions are agreed upon, the grant can be made for a term not exceeding twenty-five years. No limitation is placed upon the life of the corporation as a corporation, but only upon the length of time it may hold the grant. The statutes, however, provide for the renewal of such grants, and this operates as a safeguard for the municipality, inasmuch as it may require such rates of fare, and other terms and conditions as it sees fit, before granting such a renewal.

With the electric light companies, no consent of property owners is required, and the maximum prices they may charge, are fixed by council, for such length of time as council sees fit; but a limit is always fixed, generally from five to ten years.

In this case, also, the company may have a perpetual existence as a corporation, and the municipality is safeguarded by the right to fix the price charged for lights at the expiration of such a period.

After describing the Toledo lighting and railway plant, Mr. Lang continued: This is a brief picture of changes made necessary primarily by lack of knowledge on the part of those who had labor and, presumably, skill to sell—mistakes, to be sure, that might be expected in the haste with which we have endeavored to develop and utilize that subtle and mysterious force called electricity.

Vast sums of money have been expended—some of it, it would seem, unnecessarily wasted.

But can we say that the future will not prove it worth to the community all that it has cost?

I venture the statement, however, that could some of the owners of street railways formerly using horse power, or some of the capitalists who ventured investment in the earlier electric light

[1]Abstract of lecture delivered before Eng. Dept., Purdue University. A description of the Toledo plant is omitted, having been given very fully in The Electrical Engineer, Jan. 6, 1897.

Digitized by Google

plants, have foreseen the almost fabulous sums of money required to convert or construct the same, and the long time they would have to wait—and may still wait—for profits, there would have been much more caution, and much less progress.

Once entered upon, there was no convenient stopping place, and in many and many an instance none has yet appeared. But we can say this is American—truly American.

What has been said applying specifically to the street railway plant is equally applicable to electric lighting plants so far as the power house, repair shop, and overhead lines are concerned. Each furnishes power useful to the citizen, and each should be made profitable to its owners.

As before stated, they are each closely related to the municipality, and the community expects and demands the best possible service at the minimum of cost.

How can this be accomplished? It must be borne in mind that many existing power companies (meaning of course street railway and electric light companies) have passed through very costly experiments growing out of crude machinery and apparatus they were forced to buy, and inexperienced and incompetent persons employed to install and put the same into operation.

Finding that expenses were exceeding revenues, and grasping at every promising improvement offering greater economy, change after change has been made, and is still making, to reach better results, all of which has required increased capital stock, and the issuing of more bonds.

There was no other way to avert failure and avoid the sheriff, and thus many companies have gone forward, piling up debt upon which interest must be paid, and still the end is not yet. Every new plant installed possesses some new features that offer better service, with greater economy, and thus forces existing plants to again remodel and change and create more debt and consequent increased interest charges.

It is thus plain to be seen that the cost to the consumer must remain largely unchanged, except in a few communities where the above mentioned conditions have not so largely prevailed.

A condition such as this is, of course, unfortunate, both for the community and for the company; and no doubt leads to much discussion of the question of municipal ownership of these properties. Vainly believing that the cost of such service can be materially reduced and profits proportionally increased, municipalities desire to reap the supposed harvest. This I believe to be erroneous under present forms of society and government.

Can we expect that the addition of hundreds of men to the city pay-rolls, or the tempting opening of scores of positions to be farmed out at each municipal election will, in any respect, improve our condition?

For one, I do not believe that municipal ownership of such properties is wise in any sense nor that much will be done in this direction, especially if private corporations keep pace with the best methods of service and offer reasonable rates.

I am one who believes that the community will deal with these corporations fairly, if the corporations will be equally fair with the community. Some corporations are too exacting—too much inclined to reap a harvest of quick return by way of dividends, and provide a rapidly accumulating sinking fund to wipe out original investment.

This method, though Yankee-like, and generally called business-like, is not the prudent or wise way of handling corporations dependent on the public for their existence. A better way, it seems to me, is to take the public into your confidence, deal fairly and even generously with it, give the best possible service at the smallest profit consistent with a fair return on the investment, and reasonable provision for meeting outstanding obligations and future depreciation, in which event the community will deal fairly with you.

Citizens should be made acquainted with all the conditions governing properties of this kind, should be informed of the reason for incurring the debts which generally exist, and of the annual and contingent burdens we assume. Fulfilling these conditions, fair prices will usually be allowed for transporting passengers upon our railways, and for power and light supplied.

Where the company is left free to fix its own prices, no advantage should be taken, but a reasonable and just charge should be made, as above indicated. The tendency of the present age is toward lower prices for labor, as well as for the product of farm and factory, and lower interest on money; and electric power companies must meet it.

To do this no better method can be found than by consolidating under one roof all electric power companies where conditions are favorable. Re-equip with the latest and best types of machines for generating current, rearrange circuits for better power distribution, introduce better lamps, repair and keep in good order all the apparatus appertaining to the street railway and light plant. Give the best of service.

There is frequently no other way this can be done but through consolidation, and this can be accomplished without criticism or objection on the part of the community if followed by reduced cost to the consumer with first-class service rendered.

Corporations, like individuals, sometimes make mistakes and through miscalculating the expense of construction and operation, or in the eagerness to secure grants or for various other reasons, they assume these contracts upon terms, and at rates and prices, too cheap to permit giving the best of service, with the result that great dissatisfaction is expressed by patrons and citizens generally, and the warfare between the city and company begins. Furthermore, when such corporations have reasonably profitable contracts, they are sometimes mismanaged by their avaricious owners, scanty service is rendered their patrons and the result is the same.

Again, municipalities in some instances, through the prejudice or political aspiration of their governing boards, seeking advantage by every method known to their officials, harass corporations and thus force them to retaliate by giving poor service.

Now, gentlemen, do you perceive the call for your labor and efforts? It is here where your skill is in demand, here where it is in your power to work out the problems which will aid in putting this class of property into more profitable operation satisfactory alike to owners and to the community.

The power house, repair shop, cars, track, and lines are the dividend producers, when skilfully and intelligently constructed and operated, and you are needed to carry on this work, needed now, perhaps, more than ever before, to pilot safely to a dividend basis plants of companies already existing. Needed also to wisely inaugurate other enterprises of a similar nature, and thus extend still further the uses and advantages of this wonderful power.

The first consideration of every person as he enters the market to sell his labor, or to invest his money in commercial pursuits, is, how large a return can I obtain, either from labor alone or from labor combined with the investment of capital?

Either field is legitimate and proper, but by far the wider is that opened for the sale of labor, and its reward (if the labor be of a high order) is abundant and certain. Investment of capital with hope of great returns is speculative and uncertain. If returns are steady, they are generally moderate.

To rise above the mediocre in the sale of labor, one must either be a born genius (which most of us are not), or he must have an ardent love for his profession, and be fully equipped for its practice.

I know of no field more promising than the electrical. In it young men of energy, perseverance and devotion can make a good living and perhaps acquire a competency.

I have briefly indicated some of the problems which will confront you when you have entered into active service.

It is needless to say that you cannot be too well prepared to meet them.

Your ability and education, however, are not the only qualifications necessary to possess in order to succeed. Without an honest and faithful and constant devotion to the interest of your employer no permanent success will be attained.

You are now acquiring scientific and, as far as possible, practical information in electrical engineering. Some of you will be called to manage electrical properties, to finance them, to look after municipal, county, or State legislation. The broader your information concerning the subject, the higher the degree of usefulness you will attain.

There is, to the student, every incentive for faithful, industrious work. The possibilities are unlimited and the reward ample.

NEW YORK CITY.—The Fire Department is to have a complete telephone system, every box being made a telephone station, and the telephone will be used for second and third alarms and ambulance calls. The work of equipment is to begin at once on Broadway, from Fifty-ninth street down.

ELECTRIC HAULAGE & MFG. CO. has been incorporated under the laws of Indiana, with a capital stock of $10,000.

Digitized by Google

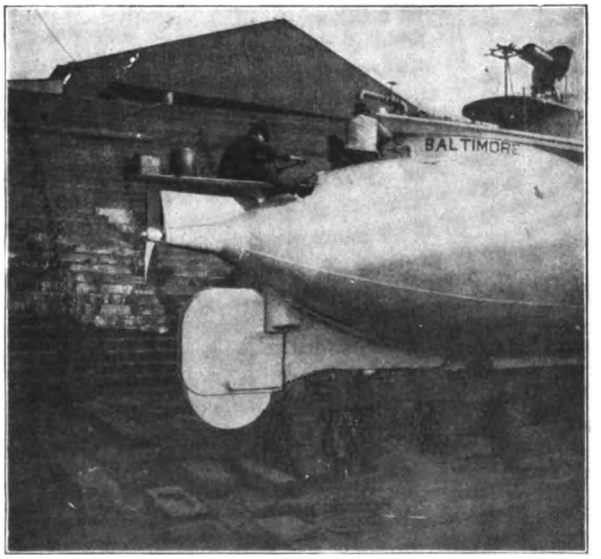
ELECTRIC TRANSPORTATION

Lake Submarine Boat "Argonaut."

THE submarine boat "Argonaut," the first vessel ever built which has navigated the surface of the ocean and crawled over its bottom, is only 36 feet long and 9 feet beam. This small craft has traveled over 1,500 miles during the past year under

"ARGONAUT" IN DRY DOCK AT BALTIMORE.

her own power in all sorts of weather while cruising on the surface, and over all kinds of bottom while submerged, and has completely proven the practicability of vessels of her type as to seaworthiness, habitableness and navigability when submerged. She is a radical departure from all submarine vessels hitherto constructed or proposed, and it is to these differences that she owes her great success. The principal features of the "Argonaut" are, (1) her means of travel while submerged; (2) means for allowing the divers to pass in and out of the vessel while

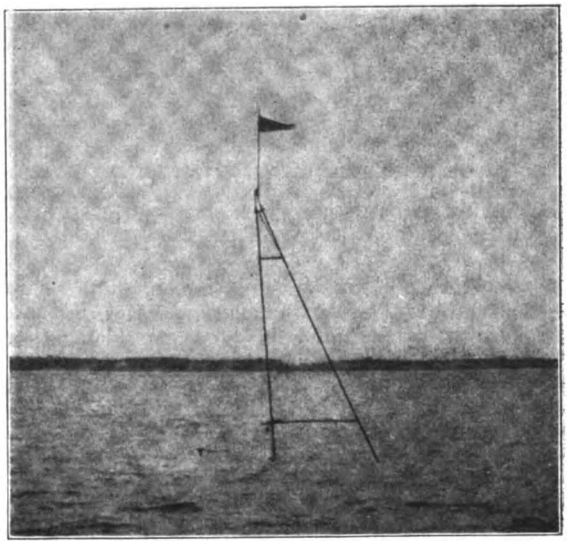


STERN VIEW OF "ARGONAUT," SHOWING GUIDING WHEEL JOURNALED IN RUDDER.

submerged, and (3) means to provide an ample supply of air while beneath the surface.

In all previous submarine vessels, the attempt has been made to navigate between the surface of the water and the water bed. The difficulties of navigation in this manner are much akin to those met with in aerial navigation. In the first place, it is necessary to maintain a perfect equilibrium and trim; submarine currents are as erratic as aerial currents and tend to affect the course of the submerged vessel; the wave motion also tends to destroy both trim and equilibrium. The majority of these vessels have been designed to dive like a porpoise, and then be controlled by vertical and horizontal rudders, or vanes placed on the sides to regulate their depth of submergence. Mr. Simon Lake, the inventor of the "Argonaut," worked many years in this line, and has taken out several patents with the above objects in view; he has designed various automatic appliances for regulating the depth of submersion, maintenance of trim, etc., etc., but did not embody any of these features in the "Argonaut," as he informs us he became convinced with his previous experiments in the submarine line that they were entirely unnecessary in waters adjacent to our coasts, as the depths are not so great but that traveling on the bottom direct is practicable, and they added enormously to the cost of a submarine vessel. There was also always the danger of failure of automatic appliances in critical times, even if someone should finally succeed in getting them to work entirely satisfactorily, which he admits is questionable.

The "Argonaut" therefore, is designed for two methods of traveling, viz., on the surface of the water, and on the bottom. On the surface she is propelled and steered as is the ordinary screw propeller. On the bottom she is propelled either by the screw propeller or by her large side-driving wheels, and guided



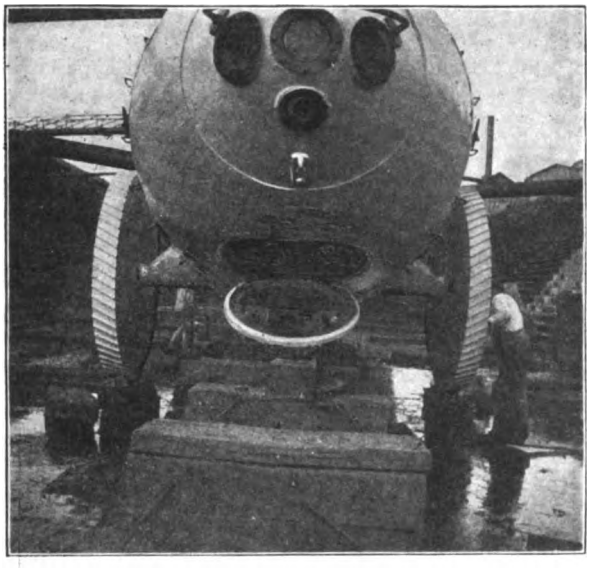
"ARGONAUT" ON THE BOTTOM OF THE ATLANTIC.
About five miles southeast by south of Cape Henry, off Virginia beach in about five fathoms.

by a third wheel journaled in the rudder. In soft bottom, the driving wheels are allowed to revolve loosely, and the propeller is used to push her along. In hard bottom or against strong currents where it is necessary to have considerable weight on the wheels to prevent her being carried out of her course, the wheels are the most effective. They are positively driven by a Hindley worm and worm wheel operated by a gasoline engine. This engine is used for both surface and submerged cruising. It is a 30 h. p. White & Middleton engine, and has some special features to adapt it to the work. When submerged, the air supply for running the engine is drawn through a pipe or hose extending to the surface, as seen in one of the figures. The burnt gases escape in the same manner. This in addition to furnishing a much cheaper power than storage batteries, has the additional advantage of furnishing an abundance of fresh air to the crew below. As the in-flow air pipe leads directly into the forward part of the living quarters for the crew in the "Argonaut," this in-flow pipe is 2 inches in diameter, and as the engine while running draws its supply of air from the after portion of the liviing compartment, this gives a constant flow of air through the vessel equal to the volume consumed by the engine (about 50 cu. ft. per minute). Mr. Lake had intended to use storage batteries in submarine cruising, but is so well pleased with the gasoline engine that he will continue to use it in all future boats built for commercial purposes. In vessels designed for war, where it

Digitized by Google

is not desirable to have any buoys or pipes showing on the surface, he will of course use storage batteries.

In traveling over muddy bottom or in quiet waters, the weight on the wheels is not over a couple of hundred pounds, but in strong currents or when there is a heavy sea running in shallow water, it is sometimes necessary to admit considerably more water ballast. While submerged off Virginia Beach last summer in about 30 feet of water, it was found necessary to admit considerably more than 1,000 pounds of water additional to keep her on the bottom. This was owing to the fact that there had recently been an "easter" and there was considerable "ground swell."



VIEW LOOKING UP UNDER BOW OF "ARGONAUT," SHOWING EXIT DOOR FROM DIVERS' COMPARTMENT, USED WHEN SUBMERGED, AND LARGE DRIVING WHEELS.

This knowledge of wave motion and ground swells convinced Mr. Lake more than anything else that the old method of attempting to travel between the surface and bottom will fail at sea or in rough waters, even though they might succeed in finally controlling them in smooth waters.

The "Argonaut" has traveled over bottoms so soft that the divers when leaving the boat would sink nearly up to their waist in mud, yet she was so nearly buoyant that the wheels did not bury over six inches. She has run up and down steep hills and across dredged channels. She will climb over any obstruction she can get her nose over, owing to the fact that she is so very buoyant.

She is divided into four compartments. One is called the living room, in which are placed the engine and all the machinery. There is also a divers' room with a door opening outwardly in the bottom; also an air lock and a forward lookout compartment. The machinery consists, in addition to the engine, of a 3 k. w dynamo for lighting the interior, and also to run the 4,000 c. p. searchlight placed in the extreme bow (which is used for the purpose of lighting up a pathway in front of the vessel as she is rolling along over the bottom); a power and hand air compressor for charging the compressed air reservoirs and supplying air to the divers; power and hand water ballast pumps, and power and hand hoisting apparatus for lifting the two heavy downhaul weights or anchors.

When the divers wish to leave the vessel while submerged, they enter the divers' room and close the door behind them, which closes on rubber packing and is airtight. Compressed air is then admitted into the compartment until the air pressure within the chamber equals the water pressure without. Then the bottom door is opened, and of course no water can enter the chamber while the air pressure is maintained, yet the divers may readily pass out or in.

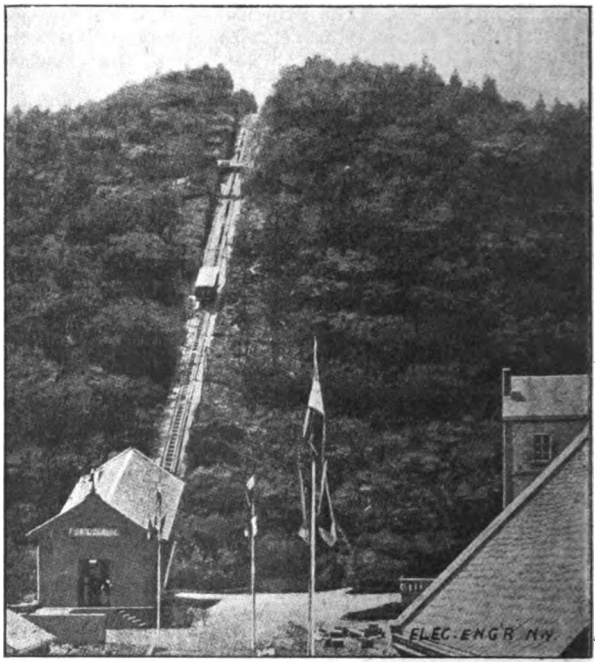
The "Argonaut" belongs to the Lake Submarine Company, with offices at No. 11 Broadway, a company formed for the purpose of exploiting Mr. Lake's inventions in the submarine line, and it is proposed to build vessels of this type for various commercial purposes. The principal one of these will be that of locating and recovering the cargoes of sunken vessels. Arrangements are about being completed to construct a vessel about 100 feet in length for this purpose. She will be of the same general style as the "Argonaut," and will be provided with all the necessary wrecking appliances, sand and coal pumps, powerful derrick, hoisting apparatus, greater speed capacity, sleeping compartments, more deck room, carrying capacity, etc.

These craft are also adapted for submarine torpedo boats, pearl and sponge fishing, laying submarine foundations and various other engineering purposes.

All experiments have been carried on publicly and many people have made descents in the "Argonaut." She is now laid up for the winter months at "Manning's" Dock, Erie Basin, Brooklyn, where she may be inspected by interested parties. Patents have been taken out in the United States and all important foreign countries, and in view of her many successful trials during the past year it is only fair to assume that submarine navigation is now beyond the experimental stage and that the next few years will see many of these amphibious craft at work.

A Three-Phase Inclined Plane Road, Mont-Dore, France.

A RECENT installation in the Puy-de-Dôme, France, shows how readily electrical methods can be applied to "funicular" or inclined plane railroads, especially under conditions adverse to the use of other power. Mont-Dore is a thermal centre in that region, lying deep down in the valley, while up on the crest of the hills, on the Capucin plateau, is a fine forest, furnishing alike a health resort and a place for excursions, but hitherto difficult of access. As there is abundant water supply in the neighborhood, it was deemed unnecessary to employ steam power, and the plan was selected of attaching a fixed motor to the cable system. The generating plant to furnish current to the motor has been erected on the canal tapping the River Dordogne at a point where there is a constant flow of about 550 litres per second, about two miles distant from Mont-Dore, the canal itself being about 2,500 feet in length. The water is carried to a power plant where a Breniet-Neyret turbine of 180 h. p. drives an Oerlikon three-phase generator, with flexible coupling, making 500 revolutions per minute and delivering current to the line at 3,600 volts, the output per phase being 12 amperes. The frequency is 50 periods per second. The rotating part of the machine carries no wire. The generator is excited by a small bipolar machine of 50 volts and 12 to 15 amperes. A small transformer in the station furnishes the current required there.



THREE-PHASE INCLINED PLANE RAILWAY, MONT-DORE, FRANCE.

The current is delivered to the line from a small switchboard

Digitized by Google

without change of pressure. The line is about two miles in length, and consists of three bare wires of 4 mm., of silicon bronze, held by double petticoated procelain insulators and carried by wooden poles. At each end there are lighting arresters. The receiving motor is in a station at the top of the inclined plane and is attached to the cable drum. With its armature running at from 400 to 490 revolutions per minute, the motor delivers from 85 to 90 h. p., taking 3,400 volt current direct from the line. The motor requires no attention and it is stated that it is only about half the weight of a continuous current motor to do the same work. There are two cars on the track, which is single, with one turn out of 38 metres for the passage of the cars in different directions. The track is 3 feet 3 inch gauge. Each car will accommodate 50 passengers. Every provision has been taken for the control of the electrical apparatus and for braking the cars in case of any sudden stoppage of current. The grades on the incline range from 26 to 56.1 per cent., and there is a difference of nearly 600 feet between the termini, the upper point being about 4,000 feet above sea level.

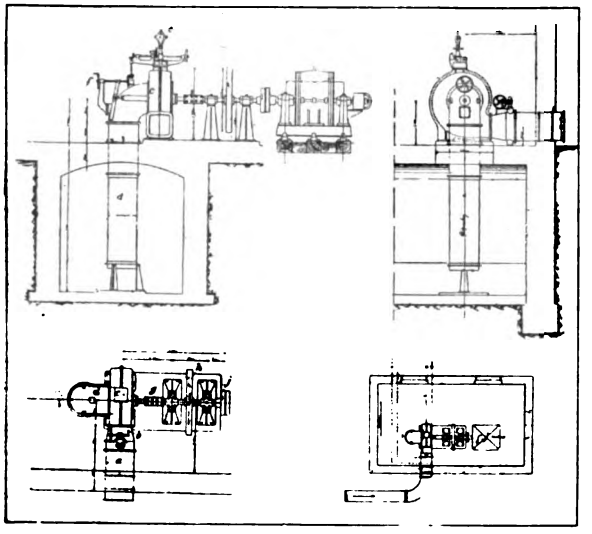


DIAGRAM OF WATER POWER GENERATING PLANT, MONTDORE ROAD.

There are a great many places in the United States, as is being shown at Niagara, for example, where similar methods are applicable, and it is believed that such roads or inclined planes operated electrically will become numerous.

Practical Points in Street Railway Engineering.[1]

BY W. A. HARDING.

THE choosing of a suitable car and equipment in the past consisted of buying car, truck and motor, without any reference as to their suitability to each other, and car or truck would have to be rebuilt to fit. I remember a company that bought long 36-foot combination cars, closed in the centre and open, with seats, at each end, having two massive four-wheel centre pivot trucks, and put in two 15 h. p. motors. Grades were from 3 to 12 per cent. It was only a short time before the motors were completely roasted. The company then went to the expense of cutting the body down to two-thirds size, taking one truck and lengthening out to 7 feet, and putting in two 15 h. p. motors. The equipment now ran very satisfactorily, but owing to poor construction of the car body, they would "hog-back" in a very short time, necessitating constant renewals of subsills, etc.

Now, what cars shall we use? Take a supposed case. For winter the public demands a five-minute schedule and the average load is from 25 to 35 people, during rush hours, say, 100 people per load. We do not want to haul around a large car empty half the day, so we will put on a 22-foot car as large as is advisable for a single truck, with two motors and large and roomy platforms; if in a cold climate, preferably vestibuled. Now if the cars should be a little crowded, the platform would always accommodate a few. When the rush comes on, one or two trailers could be added for a few hours. If quickness and dispatch in unloading are not the predominating features, or too many transient passengers, a large double truck trailer car is in my mind much the better. They are easier for motormen to handle than two single truck cars, easier to ride, easier on the track joints, require one conductor in place of two and can make much faster time.

A word as to trucks. They should be built with the side bar in one piece having no bolts or rivets, except where the cross-braces for hanging brakes are placed. Brakeshoes should not be hung on links, but in such a way that they cannot kick and will take up their own wear. An average wheel-base of 8 feet is proper for single trucks when under a 22-foot closed body, or 10-seat open bench car.

The motors should be carefully chosen for the work to be done. A powerful motor if put under a light car hauling trailer will slip the wheels on the track and the car will not make sufficient speed; but if car body, trucks and motor are of sufficient weight to get the best traction, the train will now make faster time. The bearings of the armature should be large and fed from below with wick feed from oil, with box above to hold wool waste with additional oil in place of the usual plan of dope. Such bearings should be built outside of the motor frame and also protected by large circular discs to prevent the oil from working into the motor.

The commutator should be made of good drop forged copper bars, the diameter to be as large as possible. In G. E. 800 we use a bar 1½ inches high. By using soft amber mica between the bars, the commutator wears smooth and keeps it polished. The number of slots in the armature should be kept as low as possible, it being cheaper to make repairs when four to six coils can be put into one slot; also coils should be machine wound, a thing not possible with all our armatures now.

A motor, if carefully kept clean, the brushes properly treated and changed each night and not abused unnecessarily by the crew, will last without rewinding for from four to five years, and even longer. With proper attention to brushes, commutators of the modern type should wear not more than ⅛ inch per year.

How are we to get the voltage raised at a distant point of the line where it is required for only a few weeks in a year? The cost to install a storage battery or booster, or to put up more wire, is all out of proportion to the returns. Take one of your dynamos with a capacity equal to the load demanded at this particular point. Change your two switches to double throw. When thrown up all connections are for running as a dynamo on the switchboard in the usual way. By throwing blades down, the + of machine is thrown onto an auxiliary bus-bar and the — onto the positive main at the switchboard, making this particular dynamo in series with the station. The equalizing switch is left open; the field wires are not altered. The dynamo is now run at whatever voltage you need, may be 200 or 300. The feeder that goes out to the point of the line where you wish voltage raised is now thrown onto this booster, as we must now call it. Again, if the feeders are properly adjusted, a switch and fuse can be put in between the circuit breakers of several sections and a whole district raised in voltage, if only for a few hours during rush time. As the station usually holds a reserve unit, there is no additional outlay or expense needed. In case of a breakdown or disabled generating unit, the boosting would be discontinued until such time as repairs were made.

[1]Read before the Chicago Electrical Association, Dec. 2, 1898. Abstract.

Electric Automobiles on Fifth Avenue. New York City.

The Third Avenue Railroad Co., through three of its principal stockholders, has bought out the old Fifth Avenue Stage Line. It will abolish the horses and operate the service with electric automobiles. The line should prove a howling success. Fifth avenue is now paved with asphalt for miles, from one end to the other, and the opportunities of a paying passenger traffic are immense. The Third Avenue Co. have recently made heavy contracts with the Westinghouse Co. for the electrical equipment of its car lines, and will therefore be in a position to charge and handle its automobiles very cheaply. By means of these stages, also, the company will be placed in a better position to compete with the Metropolitan Street Railway Co. for business.

ACME ELECTRIC LAMP CO. has been incorporated under the laws of New Jersey with a capital stock of $500,000.

Digitized by Google

The Safety Third Rail Electric System at Manhattan Beach, New York.

THE system of the Safety Third Rail Electric Company, of New York, is now being installed at Manhattan Beach, for the Manhattan Beach Hotel & Land Improvement Company, for which the company has a contract to install an electric light and power plant, comprising about 800 h. p.; the power station will be completed on or about April 15, 1899, and the system, which is to be operated during the present winter, will be completed on or about February 1, 1899.

A great deal has been said in our columns relative to this system several months ago, and a full description of its workings was illustrated in our issue of April 7, 1898.

The work already started will be completed about January 15, 1899. The delay in the demonstration will be due to the non-delivery of the car body, all other material being on hand, and the system now being installed. A force of workmen has been at work upwards of four weeks, and material progress has been made.

On or about January 15 invitations will be sent from the office of this company to the leading railroad managers and electrical experts to witness the opening of the demonstration, and the company will be pleased to hear from any of those interested. A public invitation will be given through the columns of this paper.

An American Railway Map for the Paris Exposition.

A special dispatch from Chicago of Dec. 21, says: Thirty railroads were represented at a meeting held at the Grand Pacific Hotel to consider a plan proposed by Charles B. Maugham for a joint exhibit at the Paris Exposition in 1900. The plan suggested is to construct a large scenic map that shall show the route of every railroad in the country by electrical devices, and on which the elevations and natural features of the surrounding country will be shown in proper proportion and color. Secretary McGibbon, of Commissioner General Peck's office, was present and said that if the railways took up the matter the French Commission would undoubtedly give the space required. The representatives of the various railroad systems discussed the project thoroughly. It was decided to raise $100,000 for the exhibit. A committee was appointed to act with Mr. Maugham for the purpose of interesting other railroads in the project and securing the money needed to carry out the ida.

Lightning and Lightning Arresters.

MR. ALEXANDER J. WURTS, of the Westinghouse Electric Company, of Pittsburg, Pa., read a paper on Nov. 22 before the Electrical Section of the Franklin Institute, on "Lightning and Lightning Arresters." Mr. Wurts said in substance: In earlier days, when people were more superstitious than now, fires were lighted and bells tolled, to drive away the dreaded lightning; but when Benjamin Franklin established the identity between lightning and electricity, people were glad to accept the results of his experiments and adopt so reasonable a device as a lightning rod. The lightning rod was a reasonable device at that time, because the public mind was ripe for it, and Franklin had shown that not only would the rod prove a good conductor, but that points on its upper terminals would in certain circumstances, prevent the lightning discharge. Experiments were then shown, illustrating these principles. But now, after 100 years' experience, and with statistics before us, this means of protection has lost much in popularity. Aside from public buildings and houses of the less intelligent class of people, the rod is rarely seen. Statistics show that in nine years, ending 1893, in the United States, there were 4,175 fires, with a loss of $14,000,000. During ten years, ending 1893, there were 2,679 barns, 129 churches and 831 dwellings struck by lightning—less than 100 dwellings a year out of the millions in this country. During five years, ending 1894, there was a maximum loss of 336 lives. These figures are certainly not alarming, but do seem to warrant in general the use of the lightning rod. Therefore the speaker recommended this device for costly and prominent buildings, for tall monuments, church spires, brick chimneys, etc., especially in rural districts.

Experiments were then shown to illustrate how the lightning stroke gathered into a bolt. It was also shown that the kind of metal of which the rod is constructed is of small importance. Globular lightning was thought to be a fact, and a letter was read from an eye-witness. Some interesting experiments were then shown, illustrating the damage done to electrical apparatus during the thunderstorms. Various devices which had been designed for the protection of dynamos and motors were arranged on the experimental table.

In conclusion Mr. Wurts stated that although much has been learned in recent years about lightning and atmospheric electricity, nevertheless there are still mysteries to be solved in this fascinating field of natural science.

Torpedo Militia.[1]

BY COLONEL EUGENE GRIFFIN, U. S. A.

IN the planting of the torpedoes for the defence of our seacoast cities during the war, it was found that the engineer soldiers upon whom this work devolved were entirely inadequate in numbers. This was not unexpected, as the Board of Engineers and the Chief of Engineers had previously stated in official reports that the Battalion of Engineers mustered far too few for this important work.

Volunteer Electrical Corps in various cities and towns were organized, and under the direction of the engineer officers in charge, the work of planting the torpedoes was mainly done by these electricians from civil life. This volunteer work was even carried further, and in Boston, for example, the Volunteer Electrical Corps included a division for steam engineering to place and operate steam engines for searchlights, etc., a division for outside wiring to run telegraph and telephone lines connecting range finder positions with commanding officer's post, and electric wires from dynamo to searchlights, to magazines, to casemates, etc., a division for inside wiring to run wires for lighting magazines, casemates, etc., boat divisions to man the boats for placing the mines, and a division of high explosive men to load the mines.

It was an acknowledged fact that these volunteers were more efficient than the regular soldiers, which was to be expected, as it was regular everyday work for the volunteers, and unusual work for the soldiers, for which drills could not prepare them as daily work had prepared the volunteers. Moreover, as a rule, the volunteers were a higher class of men than the soldiers.

These are very interesting facts, when we consider how important it is that our seacoast cities be promptly protected by torpedoes in the navigable channels upon the outbreak of war with a maritime power.

If we are to depend upon electricians from civil life, we should recognize this necessity and prepare for it in advance.

The Secretary of War should appoint a board of officers to collect data in reference to what was done in the way of planting torpedoes at the outbreak of this war, and to recommend what changes, if any, are necessary in our present system based upon our past experience.

Each engineer officer in charge of the torpedoes in any one of our harbors should be required to report:

(1) How many torpedoes he planted.

(2) How long it took him to do the work.

(3) What force he had to do it, how many engineer soldiers, how many men from civil life.

(4) How much of the required material he had on hand and how much it was necessary for him to secure after the declaration of war.

(5) How much he was delayed in his work in waiting for this material.

(6) How much improvised or irregular work he was obliged to execute because of the impossibility of securing the proper material.

(7) How many torpedoes should have been planted to complete the defence as required by the official plans.

(8) How long it would have taken to plant such total number of torpedoes had all the required material and all the needed men been available.

[1]Notes of suggestion made before the New York Electrical Society.

Digitized by Google

(9) What would be the total number of men required under the conditions of the foregoing question.

(10) What was found to be the relative efficiency of the engineer soldiers and electricians from civil life in this work.

(11) What would be his recommendation as to the employing of electricians from civil life in case of another war.

If it be deemed best to depend upon electricians from civil life, a volunteer organization or torpedo militia should be organized. The English have such an organization; it has been suggested previously for us.

It may be a State Militia, but it should be a United States Militia.

The first thing to determine, however, is as to the necessity for such militia, and this question such a board of officers as is proposed ought to determine.

It is a most important question for the interests and welfare of the people of our sea coast cities directly, and for all our people indirectly.

If the torpedo militia is needed, it can be organized with promptness and efficiency.

Lighting Affairs in Brooklyn, N. Y.

Kings County Electric Light and Power Company stock sold at 151 and was strong on published reports to the effect that the company will be in the Whitney combine. Work is being pushed on the Gold street power house of the company in Brooklyn. The greater portion of the machinery has been installed, and the power house will be completed and ready for business about the first week of February. It will begin operation with a capacity of 10,000 horse power, but in the near future this will be enlarged so that the Gold street power house will be the largest in Greater New York. The company has capacity on the property purchased to install a plant with more than 100,000 horse power, which is 20,000 horse power larger than the mammoth plant now being erected by the Metropolitan Street Railroad at Ninety-sixth street. The work of connecting the conduits laid by the Kings County with the Edison plant is now under way, and shortly after the first of the year the new business contracted by the Kings County Company will be supplied by the Edison plants.

Exports of Electrical Material from New York.

The following exports of electrical material are from the port of New York for the week ending Dec. 13: Argentine Republic —200 packages electrical material, $8,447; 89 packages electrical machinery, $9,203. British West Indies—63 packages electrical material, $3,135. British Possessions in Africa—16 cases electrical material, $275. Brazil—1 case electrical material, $24. British East Indies—5 cases electrical machinery, $183. Bremen —8 packages electrical material, $1,791. Cuba—29 packages electrical material, $641. Ecuador—1 package electrical material, $12. Hayti—2 cases electrical material, $207. Hamburg—63 packages electrical material, $3,089. London—31 packages electrical machinery, $4,504. Odessa—4 cases electrical material, $110. Puerto Rico—26 packages electrical material, $1,213. St. Petersburg—4 cases electrical machinery, $983. Venezuela—1 case electrical machinery, $38.

The following exports of electrical materials are from the port of New York for the week ending Dec. 20: Antwerp—15 cases electrical material, $1,281. British Australia—683 packages electrical machinery, $12,446. Berlin—3 packages electrical machinery, $606. British West Indies—2 cases electrical material, $114. Brazil—131 cases electrical material, $2,941. China—1 case electrical material, $35. Chili—54 cases electrical material, $1,059. Christiania—34 cases electrical material, $3,815. Dutch West Indies—4 cases electrical material, $62. Havre—28 packages electrical machinery, $800; 7 cases electrical material, $400. Hull—3 cases electrical material, $363. Japan—21 cases electrical material, $683. London—236 packages electrical material, $9,596. Langesand—1 case electrical material, $28. Newfoundland—3 cases electrical material, $56. Newcastle—11 cases electrical material, $1,400. Rotterdam—2 cases electrical material, $216. Santo Domingo—9 cases electrical material, $153; 1 pack-machinery, $639. St. Petersburg—4 cases electrical material. $336. Venezuela—19 cases electrical material, $216. Vienna—68 packages electrical material, $200. West Hartlepool—10 packages electrical material, $1,060.

The Influence of Mechanical Draft Upon the Operating Expense of a Steam Boiler Plant.

BY WALTER B. SNOW.

BY far the most important of the factors connected with the operating expense of a boiler plant, is the cost of the fuel. When burned under suitable conditions, the decrease in its cost far outstrips its decrease in efficiency, so that the solution of the problem involves itself with the provision of the proper conditions. As a rule the cheap fuels, like the fine anthracites, require for their combustion an intensity of draft, which the ordinary chimney is incapable of producing. Speaking of the chimney in this connection, Coxe asserts that "it is always very difficult, in fact almost impossible, to obtain with it sufficient blast to burn the smallest sizes of anthracite coal, which require a strong and concentrated draft." It is here that mechanical draft presents itself as a solution, for it fully meets the most exacting requirements as regards intensity, costs far less for its installation than a chimney of equivalent capacity, and is capable at all times of producing the blast necessary for securing the best results in the fornace.

What these requirements are is evidenced by the accompanying figures from careful tests by Coxe.

RESULTS OF TESTS OF PEA AND BUCKWHEAT COAL.

Kind of Coal.	Rate of combustion per square foot of grate per hour.	Pounds of water evaporated from and at 212° per pound of coal.	Air pressure in inches of water.	Maximum limit to size of coal in inches.
Oneida Pea Coal	13.63	8.56	0.875	$\frac{1}{8}$
" No. 1 Buckwheat..	13.58	7.94	0.5	$\frac{9}{16}$
" No. 2 "	11.40	8.60	0.625	$\frac{3}{8}$
" No. 3 "	11.34	8.65	1.04	$\frac{3}{16}$
Eckley " "	9.44	8.75	1.125	$\frac{3}{16}$

These coals, which are among the smallest in size, were burned on a special form of traveling grate and the air pressure was maintained in a chamber beneath.

It is noticeable that with a practically constant combustion rate and evaporative efficiency, the draft increases very rapidly as the size of the coal decreases.

RELATIVE EFFICIENCIES OF VARIOUS COALS.

Kind of Coal.	Water evaporated from and at 212° by one lb. of Dry Coal.	Relative efficiency in per cent. Cumberland = 100.	Cost of coal per ton.	Fuel cost of evaporating 1,000 lbs. water from and 212°.	Relative efficiency in per cent. measured by cost to evaporate 1,000 lbs. Cumberland = 100.
Cumberland	11.04	100	$3.75	$0.1698	100
Anthracite, Broken.....	9.79	89	4.50	0.2297	74
Anthracite, Chestnut	9.40	85	5.00	0.2660	64
Two parts Pea and Dust and one part Cumberland.....	9.88	85	2.'8	0.1375	123
Two parts Pea and Dust and one part Culm.....	9.01	82	2.58	0.1432	119
Anthracite, Pea	8.86	80	4.00	0.2259	75
Nova Scotia Culm	8.42	76	2.00	0.1187	156

The comparative efficiency of various coals as determined by Barrus, is indicated in the accompanying table, which speaks for itself. The evidence in favor of burning low grade fuels is conclusive, so far as these results indicate. Such results can, however, only be secured by positive and intense draft.

It is true that as the quality of the coal grows poorer and the size of the particles less, it becomes more necessary to provide some special form of grate or stoker for its proper burning. But even without an economizer to utilize the waste heat, the

Digitized by Google

burning of cheap fuel by mechanical draft will, under perfect conditions, show a decided saving, after due allowance is made for fixed charges on the special furnace arrangements and for the cost of operating the fan.

ANNUAL SAVINGS RESULTING FROM BURNING CHEAPER FUEL IN 1,000 H. P. BOILER PLANT.

Water evap. from and at 212° per lb. of coal.	Cost per Ton.														
	$0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
11 00											4892	3669	2446	1223	0000
10.50										5474	4193	2912	1630	349	
10.00									6115	4770	3424	2079	734		
9.50							8240	6823	5407	3991	2575	1159			
9.00						9105	7610	6115	4621	3126	1631	136			
8.50					10,074	8491	6909	5326	3743	2160	578				
8.00				11,180	9,478	7797	6115	4433	2752	1070					
7.50			12,398	10,599	8,805	7012	5218	3424	1630						
7.00	15,724	13,803	11,881	9,959	8,087	6115	4198	2272	350						

The possible savings with low grade fuels and mechanical draft are still further evidenced by the accompanying tables which show for a 1,000 horse power plant, the annual saving, based on 312 days of 10 hours each, which would result from the substitution of a cheaper fuel for, say, Cumberland coal, costing in round figures, $4 per ton, and evaporating 11 pounds of water from and at 212° per pound of coal. Under these conditions the annual fuel expense would be $19,568.00. If the assumption be made that a coal costing $2.50 and evaporating only 9 pounds of water is substituted, the annual saving would be $4,621.00. The full cost of operating the fan even if the exhaust steam was not utilized and it required 1½ per cent. of the total coal burned, would be only $224.00, and if this were charged against the saving it would still amount to $4,397.00, a sum sufficient to show a most creditable reduction in operating expense, even if there was also charged against it any additional labor and the fixed charges on a complete equipment of special appliances for burning the lower grade fuel.

In general practice a mere change of grate bars is sufficient to adapt a boiler for burning almost clear yard screenings by means of mechanical draft.

RESULTS OF OPERATION WITH CHIMNEY DRAFT.

Time.	Kind of Coal.	Number of Tons.	Cost per Ton.	Total cost of Each Kind of Coal.	Weight & total Cost of Coal for Year.
Dec. 1, 1892 to Nov. 30, 1893	Hard coal screenings.	232	$1.25	$1,072.45	4,751.24 tons $10,157.38
	Hard coal screenings.	601.9	1.30		
	Soft nut.	606.95	2.20	$9,084.92	
	Soft nut.	15.04	2.25		
	Soft nut.	1,759.6	2.30		
	Soft nut.	1,445.75	2.40		

RESULTS OF OPERATION WITH MECHANICAL DRAFT.

Dec. 1, 1893 to Nov. 30, 1894	Hard coal screenings.	1,299.95	$1 30	$5,356.24	5,013 tons $7,680.93
	Hard coal screenings.	2,610.8	1.40		
	Hard nut.	3.02	3.50	$2,333.69	
	Soft nut.	843.03	2.10		
	Soft nut.	255.9	2.20		

A reduction of over $125.00 per week, equivalent to $6,500.00 per year, has been made in actual practice in the case of a boiler plant of 1,000 horse power, by the introduction of mechanical draft, and the burning of yard screenings with a slight mixture of Cumberland.

A very interesting example of the reduction in fuel cost incident to the introduction of mechanical draft is that now presented. (See table above.)

Although the annual coal consumption was increased, as was to be expected with the lower grade of fuel, yet a reduction of nearly 25 per cent. in the cost was effected.

With the increasing interest in the possible reductions in operating expense, more attention is being turned to the mechanical stoker, both as a means of more economically and of more uniformly supplying the fuel to the furnace. As incidental to its success, positive and automatically regulated draft is a necessity. This is particularly true in the case of the modern forms of under-feed and chain-feed machines. The forced draft method of mechanical draft is generally employed and the necessary arrangements are of the simplest character.

A comparatively small high speed fan is generally employed for this class of work, and so located as to occupy no valuable space.

In so far as mechanical draft is an absolute necessity to the operation of a mechanical stoker of the types just mentioned, such increase as is thereby secured may, to a considerable extent, reasonably be credited to it. The inadequacy of the chimney for producing the draft for burning small anthracite coal has already been pointed out.

The operation of a stoker is generally conducive to a reduction in the quantity of air required for combustion, which economy is in line with that resulting from the use of mechanical draft.

Naturally, in a thorough consideration of the relative merits of chimney and mechanical draft, consideration must be given to first cost, and to the efficiency with which the fuel is burned, in addition to the discussion of the relative operating expense which has here been presented. It is also to be noted that when the fan is employed for draft production, the steel plate construction, the comparative lightness, the portable character and the absence of heavy foundations, render extremely simple its adaptation to the exact requirements. Being portable it is also salable, and hence an asset of real value as compared with the chimney. It may be used either for forced or induced draft and placed where it will occupy no valuable space. It may be operated by direct connected or belted engine or motor, and so proportioned as to produce any desired draft pressure.

In operation, the fan is both positive and flexible, independent of the weather but capable of regulation to the finest degree and of adjustment to the necessities of the fire at any particular moment. A mere increase in the cut-off of the fan engine brings about a result only secured with a chimney at the expense of adding to its height, while a change in the fan speed alters both the volume handled and the intensity of the draft produced.

The growing interest in the matter of mechanical draft production is the best indication that it is to become a close rival, if not a successor, of the present method—by means of a chimney.

PATENT NOTES.

A Valuable Electrical Invention.

Mr. Frank M. Archer, of New York City, has found another use for electricity in the household, and in such a way that the present and future generations must look upon his name with gratitude and reverence like that bestowed for the same reasons by the sons of Erin on their patron saint. The appliance is described in U. S. patent No. 616,049, bearing the title, "Electrical Bedbug Exterminator." It comprises pairs of contacts in an electrical circuit, so arranged upon the frame of the bedstead that any insect promenading thereupon in a longitudinal direction will meet with a horrible end. The inventor does not disclose what would happen to latitudinarian bugs.

WILLIAMSPORT, IND. The Williamsport Water and Light Company has been formed, with a capital stock of $10,000, by J. H. Brown, B. O. Mayer and G. Mayer.

Digitized by Google

SOCIETY & CLUB NOTES

Chicago Electrical Association and "Wireless Telegraphy."

At the regular meeting of the Chicago Electrical Association on December 16, Mr. Arthur Vaughan Abbott, chief engineer of the Chicago Telephone Company, delivered a lecture on "Wireless Telegraphy." His practical demonstrations with working apparatus were enthusiastically received by a large audience. Mr. Abbott has been experimenting with and developing his apparatus during the past year and now he has established communication between his office and residence, two miles distant. In the lecture the principles underlying wireless telegraphy were fully explained with due credit given to Hertz and other pioneers and later investigators as Marconi. After the lecture the annual election of officers was held with the following result: President, Thomas G. Grier; vice-president, J. M. Hollister; treasurer, Harold Almert; secretary, Cloyd Marshall; and directors, F. S. Hickok, E. W. Jewell and Hayward Cochrane. Cloyd Marshall, secretary, has his headquarters at 1310 Monon Building, Chicago.

Virginia Street Railway Association.

Representatives of seven street car systems and electric companies operating in Virginia met at the Westmoreland Club, Richmond, Va., last week and organized the Virginia Street Railway Association. The companies represented were the following: Richmond Traction Company, Staunton Street Car Railway Company, Roanoke Street Railway Company, Roanoke Light and Power Company, Lynchburg and Rivermont Railway Company, Norfolk Street Railway, Norfolk and Ocean View Railway Company. Officers were elected as follows: R. D. Apperson, of Staunton, president; E. Randolph Williams, of Richmond, vice-president, and E. P. Woodson, of Lynchburg, secretary and treasurer. The annual meeting of the association will be held in Richmond on the 16th of next May.

Northwestern Electrical Association.

Mr. T. R. Mercein, 22 Sentinel Building, Milwaukee, secretary and treasurer, announces that the seventh annual convention of the association will be held at Hotel Pfister, Milwaukee, Wis., commencing on Wednesday, January 18. The following papers will be read and discussed: "Trend of Central Station Design," by B. J. Arnold, Chicago; "Meter-Rate Systems," by E. L. Debell, Sheboygan, Wis.; "Design of Secondary Circuits in Alternating Plants," by George L. Thayer, Belle Plaine, Iowa; "Electricity Direct from Coal," by Prof. A. J. Rogers, Milwaukee; "Inductive Loads on Alternating Current Transformers," by Prof. D. C. Jackson, Wisconsin University; "Electric Vehicles and Their Relation to Central Stations," by H. M. Maxim, Hartford, Conn.; "Association Management," by H. L. Doherty, Madison, Wis.

Mr. Frank L. Perry, Chicago, has kindly consented to give his new and successful illustrated lecture on "Curious Things Electrical," in connection with musical and electrical Indian club exercises and novel pyrotechnic effects by Mr. George W. Patterson, of Chicago.

The association will, at this meeting, inaugurate the "Question Box" on a new plan designed to remedy the defects of that institution as usually conducted. Members are invited to mail to the secretary prior to January 10, questions on any matter connected with the business upon which information is desired, signing "as an evidence of good faith, not for publication." All questions received will be printed in the second, and final, notice together with a request for prepared answers to be ready at the convention when called for. Mr. Mercein has secured the usual one and one-third fare from the Western Passenger Association, conditioned upon 100 certificates of attendance. The railroad joint agent will be in attendance at the convention all Thursday, January 19, to countersign certificates. Mr. James Wolff, 320 Dearborn street, Chicago, with Mr. W. W. Low and Mr. George S. Whyte, of that city, will have charge of transportation arrangements for delegates coming from or through Chicago.

The Hotel Pfister makes the usual reduced rates to delegates. Rooms and exhibit space should be secured well in advance. A banquet, theatre parties, sleigh rides, etc., are being arranged for, and enjoyable entertainment for all is assured. Officers will be elected, summer meeting plans proposed and discussed, committees appointed and other business transacted. It is expected that the coming convention will be the largest and most interesting that the association has ever held.

OBITUARY

Ronald T. McDonald.

We regret to note the sudden death, on Dec. 24, of Mr. R. T. McDonald, of the Fort Wayne Electric Corporation, at Dallas, Texas. He was born in Pittsburg, Pa., forty-five years ago. He engaged at first in the dry goods business and later became interested in electric lighting. He lived in Fort Wayne, where he owned a large stock farm, upon which he bred blooded horses and cattle.

He was vice-president of the Fort Wayne Lamp Company, of Cleveland, Ohio. He was the owner of an artificial ice plant in New Orleans, and of a paper mill in Ironton, Ind. He had a large contract for sewers in New Orleans, and was interested in electric lighting and street surface railways in many of the larger cities. He was a promoter of many enterprises, as well as a manager.

As one of the directors of the Madison Square Bank Mr. McDonald was indicted in 1893, together with other officers of the bank, for receiving deposits after it was known that the bank was insolvent. The indictment was afterward dismissed on the ground that it was too indefinite. Mr. McDonald maintained that his connection with the bank would bear the closest scrutiny. At that time he was vice-president of the Municipal Ice Company. He was also, it is said, the largest individual stockholder in the Hoffman House, one of the finest hotels in New York City.

Mr. McDonald was a man of tireless industry and a remarkable constitution. Those who knew him said that he was able to rest by turning his mind from the details of one business project to another. It was his custom to tax his strength to the utmost. He traveled incessantly, having a private car for the purpose. He took a deep interest in national politics as a Republican.

As to the cause of his death, President J. P. Cadogan, of the Hoffman House Company, says that Mr. McDonald left this city six weeks ago, saying that he would surely return in a week. He went to New Orleans to attend to his interests there, and then to the West. He was in Dallas on business when his death occurred. He leaves a widow and a daughter fifteen years old. The funeral will take place in Fort Wayne. It is believed that he left a large estate, but one which, owing to its multiplicity of interests, will require a long time to settle and clean up for the benefit of his heirs. It is privately reported that his secretary, Mr. Henry J. Miller, of the Fort Wayne Corporation, will in all probability administer the estate.

Dr. Wellington Adams.

We regret to note that Dr. Wellington Adams, inventor and projector of the Chicago and St. Louis Electric Railway, died on Dec. 19, of pneumonia, at his home in St. Louis. He was 50 years old, and leaves a widow and six children. His wife was Miss Susie Slayback, eldest daughter of Attorney Alonzo Slayback, whom the late John A. Cockerill shot down in the editorial rooms of the St. Louis "Post-Dispatch" several years ago. Dr. Adams asserted that he was the inventor of the electric motor application of electric power direct to the axle, and squandered a fortune in endeavoring to establish his rights to this patent, but failed of recognition in the courts. He also proposed a high speed electric road between Chicago and St. Louis at the time of the World's Fair, but although a great deal of money was raised for the enterprise and construction of the line started, the scheme fell through in disastrous failure.

Digitized by Google

Frederick C. Whitmore.

Mr. Frederick Culver Whitmore, of the Railway Engineering Department of the General Electric Company, died, at the early age of twenty-six years, of typhoid fever at his home in Hartford, Conn., on December 7.

Mr. Whitmore began his career with the Thomson-Houston Company, on the "students course," at the Lynn factory, from which he was advanced to the Power and Mining department, where he was engaged chiefly in design. In 1894, he was transferred to the Scranton, Pa., office of the General Electric Company, where he was general consulting engineer in power and mining work till 1898, at which time he returned to the home office in Schenectady. His work at Schenectady was wholly with the Railway Engineering department in which at the time of his death he was filling with conspicuous success, an important post in connection with the design of special railway apparatus.

Mr. Whitmore was a man of uncommon gifts, who possessed unlimited energy and enthusiasm in his work. He had, beside, a manly and straightforward character and numerous qualities of personal charm which won him friends and gained him universal esteem.

THE STOCK MARKET

Strong Commercial and Financial Conditions.

The past Christmas week was one of the busiest ever seen in this country, and the reports from every quarter as to the outlook were most encouraging. The rush of iron and steel business is immense. The copper market is very active. In cotton there is notable strength. The produce markets are in cheerful mood. Jewelry manufacturers have been doing well and the retail trade throughout the country surpassed all expectations. Yet the money market has remained very easy, business failures are only normal, bank clearings are heavy, deposits have increased, and railroad earnings are gratifying in their gains.

Usually the Christmas stock market is dull and reactive, but this year it was all the other way, the daily sales of stock for the five days reaching about 800,000 shares, while prices were generally strong or advancing. The bond market was also busy. During the week 8,050 shares of Western Union were sold, closing around 92⅞. Of General Electric, 6,315 shares were sold, closing at 94. New York Edison was sold to the extent of 2,082 shares, closing at 192. Metropolitan Street Railway Co. was less active, but 14,520 shares exchanged hands, closing at 191¾. In Boston, Am. Bell Telephone was inactive, closing at 275 on sales of only 331 shares. West End Railroad was a little higher, closing at 90.

Copper, last week, New York, was quoted at 12.85 cents. Heavy steel rail, Eastern mill, is listed at $17. Metals generally are showing a tendency to advance.

REPORTS OF COMPANIES

Sale of the Wenstrom Co. of Baltimore.

The charter of the Wenstrom Electric Light Company, of Baltimore, Md., has been sold, but the identity of the purchasers cannot be ascertained.

It was learned, however, that the price paid for the charter was $10,000 and that it is the intention of those who have acquired it to form a company to engage in the electric lighting business. Messrs. Steele, Semmes, Carey & Bond conducted the negotiations on the part of the purchasers, but Mr. Francis K. Carey, of that firm, said he was not at liberty to divulge the identity of the buyers or the facts connected with the deal. The Consolidated Gas Company had an option on the charter, but permitted it to expire last Friday without exercising it. The announcement caused a sharp break in Consolidated Gas stock.

The Wenstrom Company was organized about ten years ago. The old Five Mills property on the Gwynn's Falls run, between Walbrook and Calverton, was obtained, and a factory of stone and brick, 100 by 200 feet, erected. The first president of the company was Mr. E. L. Tunis, who was then president of the Tunis Lumber Company. The manufacture of electric motors was the principal business, and predictions of immense profits on its stock were made. It did not succeed as soon as some of the largest stockholders desired, and the Baltimore capital was almost entirely withdrawn from the concern. In 1891 it went into the hands of receivers, General Latrobe being one of those appointed by the court. After some time and considerable financiering, it was reorganized, General Latrobe being elected president. Until a year or so ago the plant was by special arrangement operated by the Fort Wayne Electric Company. Since the withdrawal of that company it has been idle. The plant is variously estimated to be worth anywhere from $100,000 to $200,000, while patents it owns are considered as valuable. It has been said that the concern would have been at this time worth $1,000,000 had not the Baltimore capital in it been withdrawn. The plant is operated by water power.

Pelton Engineering Co., Cleveland, O.

The Pelton Engineering Company has been incorporated at Cleveland, Ohio, by Mr. W. H. Pelton, Mr. H. H. Holding, and Mr. Allan Bassett, and has acquired all the available assets of The Cleveland Electric Trading Company, formerly doing business at 806 The Cuyahoga, and of The Cornman Company, assigned. It is the purpose of the new corporation to act as contracting engineers in the erection of steam and electric plants and as manufacturers' agents for a few first class lines of apparatus. They have already some very good agencies, and have considerable work on hand. They will also carry a full line of station supplies, making a specialty of repairs and supplies for Brush arc apparatus. The company expect to locate very shortly at 1076 Hamilton street, in the buildings now occupied by The Parish & Bingham Co., and will be exceptionally well located for the handling of general electrical business.

As to the personnel of the firm, it may be stated that Mr. Pelton has had years of active experience handling electrical machinery, and in the design and erection of power station work, and is well fitted for handling very heavy erection. Mr. Holding, the vice-president of the company, graduated from Rose Polytechnic Institute in 1887 and entered the engineering department of the Thomson-Houston Electric Company, remaining with them until their consolidation with the Edison interests. He then entered the engineering department of the General Electric Company, remaining with them for several years as expert, during which time he installed several very large plants. Mr. Bassett, secretary of the company, who will take the sales department, is a young man who already has an exceptionally wide acquaintance among central station men and the electrical trade. He is thoroughly familiar with the principal systems of light and power distribution and has also had considerable experience pioneering electrical enterprises.

Manufacturers who are not now represented in the central section may do well in corresponding with this company, as they will be well located and will undoubtedly make themselves felt in electrical industry.

Fort Wayne Lamp Co.

A great deal of curiosity has been felt by the trade in the affairs of the Fort Wayne Lamp Co., in connection with the sudden death of Mr. R. T. McDonald. Inquiry develops the fact, however, that his interest in the concern was by no means as large as supposed. Mr. Samuel Insull is the president of the company, and it now comes out that for some time past Mr. Joseph Insull, his brother, so long on the staff of the General Electric Co., has been the treasurer with headquarters at Cleveland. We are not able as we go to press to determine Mr. McDonald's exact holdings in the company, but the facts just mentioned show where the control lies and imply that the lamp company is in very strong hands. As between the Fort Wayne Electric Corporation and the Fort Wayne Lamp Co. absolutely no relationship at all is discovered to exist, other than as intimated above. The Lamp Co. is understood to be doing a large and growing business.

Digitized by Google

INVENTORS RECORD

Classified Digest of U. S. Electrical Patents Issued Dec. 13, 1898.

Alarms and Signals:—

FIRE ALARM INDICATOR. Leonard Le Baron, Pensacola, Fla., assignor of one-half to Henry H. Thornton, same place, 615,723. Filed Sept. 29, 1897. Details of construction.

RAILWAY CROSSING SIGNAL. John D. Taylor, Chillicothe, Ohio, 615,762. Filed Jan. 12, 1898. Comprises a signal-sounding mechanism, consisting of an electric motor, an electric circuit in which the motor is arranged, a cam operated by the motor, a bell-sounding lever operated to sound the bell upon each complete rotation of the cam, another cam having a step-by-step rotary movement, and a circuit-closing lever operated by the last named cam, for cutting out the motor.

Conductors, Conduits and Insulators:—

METHOD OF MANUFACTURING ELECTRICAL CABLES. Sebastian Ziani De Ferranti, Hollinwood, England, 615,691. Filed Dec. 28, 1897. Consists in first forming a circular stranded conductor passing the same between rolls to compress it to the shape of part of a circle in cross-section, insulating the conductor, and lastly laying a number of such conductors together to form an approximately cylindrical cable.

VACUUM INSULATOR FOR ELECTRIC CONDUCTORS. Joseph A. Poche, New Orleans, La., 615,896. Filed Oct. 6, 1898. Consists of a sleeve through which the conductor is adapted to pass, and a chamber surrounding the sleeve and secured thereon air-tight, the chamber being exhausted of air to create a high vacuum therein and form an internal resistance in the insulation.

Distribution:—

METHOD OF AND APPARATUS FOR ELECTRICALLY TRANSMITTING POWER. Charles S. Bradley, Avon, N. Y., 615,673. Filed July 14, 1897. Means to permit alternating current railway motors to have their speed and torque varied by supplying them with currents of variable frequency, the currents being derived from a simple alternating current circuit of single phase, extending along the railway line.

CONTROLLING ALTERNATING CURRENT MOTORS. Charles S. Bradley, Avon, N. Y., 615,953. Filed July 14, 1897. An alternating current system comprising a source of alternating currents, a free running motor generator supplied thereby, a work circuit supplied with alternating currents by the motor generator, a plurality of motors having their armatures supplied by the work circuit and their field magnets excited by a direct current and means for varying the strength of the direct current.

CHANGING PERIOD AND PHASE OF ALTERNATING CURRENTS. Charles S. Bradley, Avon, N. Y., assignor to the General Electric Co., New York, 615,954. Filed June 22, 1896. Renewed Nov. 17, 1898. A method of altering the rate of an alternating current consisting in leading the current through a motor generator, feeding a work circuit from the secondary of the generator, and controlling the rate by altering the phase relation of the work current.

Dynamos and Motors:—

DYNAMO-ELECTRIC MACHINE. William Morris Mordey, Loughborough, England, 615,731. Filed Feb. 15, 1897. Embodies an armature having each element of its winding arranged as a pair of coils so disposed and connected that during the greater part of the revolution the electromotive forces in the two coils are additive, while at the time of commutation they are in opposition.

DYNAMO-ELECTRIC MACHINE. William Morris Mordey, Loughborough, England, 615,732. Filed Dec. 30, 1897. Similar to above.

ALTERNATING CURRENT GENERATOR. Chas. S. Bradley, Avon, N. Y., 615,952. Filed July 14, 1897. An alternating current generator having one member excited by a free running dynamo-electric machine whose field magnet is charged by a direct current of variable strength.

ELECTRIC MOTOR. Julius L. Thoma, Kansas City, Mo., assignor of seventeen-twentieths to Agnus M. L. Miller, Crescent P. Brod, Louise V. Panhoff and John Potzner, same place, 616,035. Filed June 20, 1898. Details of construction.

Electro-Metallurgy:—

ELECTROPLATING APPARATUS. John Eborall Hartley and Herbert Edward Hartley, Birmingham, England, 615,699. Filed Dec. 28, 1897. A vertically freely suspended cathode carrier having an undulated under edge with fixed controlling projection.

APPARATUS FOR DEPOSITING METAL ON TUBES OR PIPES. Walter Wright, Acocks Green, England, assignor to the Standard Electro-Galvanizing Co., Ltd., Birmingham, England, 615,940. Filed Dec. 27, 1897. Comprises a cathode support, a revolving disc, carrying one end of the anode rods and a conductor embracing the periphery of the disc and having electrical connection with the anode rods.

Lamps and Appurtenances:—

ELECTRIC LAMP. Walter Scott Doe, Jersey City, N. J., assignor of one-half to John H. Weastell, same place, 615,686. Filed Aug. 12, 1897. Renewed April 29, 1898. Comprises a metallic casing, a coiled spring secured at one end in the casing and into which screws the bulb of the lamp, and a battery having a jar of an insulated material and removably contained in the casing, the jar having a contact plate to make a contact with the bulb on placing the battery into the casing.

Measurement:—

HYSTERESIS-METER. James Lester W. Gill, Montreal, Canada, 615,695. Filed March 25, 1898. Comprises a solenoid adapted to have a motion along the sample of iron being tested, with means for operating the soleniod, the specimen of iron being supported so that the force of attraction of the solenoid will proportionally move the specimen, and means for indicating the work done.

Miscellaneous:—

THERMOSTAT. Ira F. Beers and Frederic C. Beers, Rochester, N. Y., 615,669. Filed April 5, 1897. Designed for operating a circuit controlling a valve in a heating system.

ELECTRIC FIRING DEVICE FOR ORDNANCE. Arthur Trevor Dawson and George Thomas Buckham, London, England, assignors to the Vickers' Sons & Maxim, Ltd., Sheffield, England, 615,814. Filed May 16, 1898. Consists of a wire connecting a source of electricity to a spring plunger, a trigger lever having an arm adapted to form a conducting bridge to a piece of metal, a wire connecting this piece of metal to a switch on the gun cradle, the switch being provided with a spring and lever arm having a pin in the path of the breech ring of the gun, and a wire connecting the switch to the firing fuse.

ELECTRICAL BEDBUG EXTERMINATOR. Frank M. Archer, New York, N. Y., assignor to Siegfried Silberberg, New York, N. Y., 616,049. Filed Feb. 7, 1898. Employs pairs of electrical contacts consisting of strips surrounding the framework of the bedstead and insulated from each other, whereby an insect, in traversing the frame in the direction of its length, must necessarily close the circuit between the contacts, and a source of electricity connected with the contacts.

BALL-BEARING FOR ELECTRIC MOTORS. John M. Murphy, Torrington, Conn., assignor of two-thirds to David F. Halsted, New York, N. Y., and William M. Keepers, Newark, N. J., 673,971. Filed March 15, 1898. Details of construction.

Railways and Appliances:—

ELECTRIC LIGHTING APPARATUS FOR RAILWAY CARS. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place, 615,904. Filed July 7, 1898. A dynamo is mounted on the car and geared to the axle.

ELECTRIC LIGHTING APPARATUS FOR RAILWAY CARS. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place, 615,905. Filed July 9, 1898. Employs a dynamo pivotally supported at one end on the railway car, whereby its opposite free end is capable of moving vertically with reference to the car axle, a yielding support which carries the free end of the dynamo, and a frictional driving mechanism whereby the dynamo is driven from the axle.

ELECTRIC ARC HEADLIGHT. William G. Wagenhals, Dayton, O., assignor to the U. S. Headlight Co., Utica, N. Y., 615,927. Filed Nov. 18, 1897. Details of construction.

TROLLEY REPLACER FOR ELECTRIC RAILWAYS. L. A. Cowles, Cowles, Randolph, Mass. Filed Feb. 7, 1898. With the pole is combined a forked lever having flaring ends and swing guides properly connected with the trolley pole and adapted to be moved by the forked lever.

TROLLEY WHEEL REPLACER. George E. Mittinger, Jr., Cleveland, O., assignor of three-fourths to Frederick J. Schweitzer, same place, 616,061. Filed Sept. 2, 1898. A sheet metal replacing section for trolley wheels consisting of a truncated sheet metal cone having formed directly therein a spiral groove by depressing the outer surface and having an integral inwardly projecting U-shaped wall forming a bearing.

Telephones:—

TELEPHONE SWITCHBOARD. Thomas F. Ahern, Detroit, Mich., assignor to the Detroit Switchboard and Telephone Construction Co., same place, 616,046. Filed May 27, 1897. A "duplex switchboard" system consisting of two separate series or banks of jacks, one of which is termed the "answering" division and the other the "connecting" division.

Classified Digest of U. S. Electrical Patents Issued Dec. 20, 1898.

Alarms and Signals:—

ELECTRICAL BURGLAR ALARM. Clyde Coleman, Chicago, Ill., assignor by mesne assignments, of two-thirds to George P. Jones, Chicago, Ill., 616,079. Filed June 29, 1896. Employs a closed controlling circuit, and a plurality of interrupted circuits laid in reverse directions and charged with electricity at the same potential as is the controlling circuit, all of the circuits being insulated from each other and braided together.

THERMOSTATIC AUXILIARY FIRE ALARM SYSTEM. Albert H. Cross, New York, N. Y., asignor to the Gamewell Auxiliary Fire Alarm Co., Boston, Mass., 616,082. Filed June 1, 1898. Comprises a street box, combined with a normally-closed auxiliary circuit, including a section of fusible wire extending throughout a building, and a thermostatic wire arranged parallel to the fusible wire and normally disconnected from the auxiliary circuit.

AUXILIARY FIRE ALARM TELEGRAPH APPARATUS. Bartholomew Oehmen, New York, N. Y., assignor to the Gamewell Fire Alarm Telegraph Co., New York, N. Y., 616,136. Filed Jan. 14, 1898. Details of construction.

INDICATOR. Frederick Hackmann, Milwaukee, Wis., assignor by direct and mesne assignments to the Automatic Indicator Co., Milwaukee, Wis., 616,417. Filed Nov. 26, 1897. A device in which numbers or digits are printed on a movable slip of paper in contradistinction to marks or dashes printed on a movable slip of paper.

Dynamos and Motors:—

FIELD MAGNET FOR ELECTRIC MACHINES. Sidney H. Short, Cleveland, Ohio, 616,265. Filed July 28, 1898. A field magnet for electric machines having grooves formed in the pole-surface combined with a grid arranged to be received in the grooves.

ELECTRIC GENERATOR FOR CYCLES OR OTHER VEHICLES. James Moorse and Henry Oliver Farrell, Manchester, England, 616,343. Filed May 24, 1898. A generator having a driving pulley and bearings approximately parallel to the plane of the vehicle wheel and means whereby the generator is yieldingly pressed against the wheel.

COMBINED BEARING AND POWER TRANSMITTING DEVICE. Carl O. C. Billberg, Lewisberg, and Paul A. N. Winand, Philadelphia, Pa., 616,396. Filed Nov. 23, 1897. Embodies a shaft with two or more pinions thereon and carrying the armature, a pulley concentric with and surrounding the pinions, and intermediate wheels constituting the only bearings for both the pulleys and the pinions and also as a means of transmitting power from one to the other.

Lamps and Appurtenances:—

ARC LIGHT REGULATOR. William J. Kelly, Boston, Mass., 616,111. Filed Jan. 29, 1896. Renewed June 1, 1898. Comprises a variable resistance composed of a series of resistances, increasing and diminishing irregularly to enable the arc lamp to be regulated without interfering with its functions, and a circuit controller co-operating with the variable resistances.

ILLUMINANT FOR INCANDESCENT ELECTRIC LAMPS AND PROCESS OF MAKING. Orlando M. Thowless, Newark, N. J., 616,276. Filed Jan. 31, 1896. A method of preparing filaments for incandescent lamps which consists in first applying a covering of readily combustible material to the surface of the filament, impregnating the same with a salt of thorium and removing the covering of combustible material by heat.

Digitized by Google

Measurements:—

AMMETER FOR ALTERNATING ELECTRIC CURRENTS. Waldo A. Layman, St. Louis, Mo., 616,339. Filed April 4, 1898. Comprises a fixed element, a movable element, a primary circuit for the fixed element, a secondary circuit for the movable element, and a transformer for supplying current to the secondary circuit at a substantially constant potential.

Miscellaneous:—

PERMUTATION LOCK FOR BOXES. Henry Hinterholzner, New York, N. Y., 616,104. Filed Jan. 10, 1898. Details of construction.

PNEUMATIC MOTOR FOR ELECTRIC APPLIANCES FOR CARS. Clarence A. Evans, Upland, Pa., 616,301. Filed July 13, 1897. A car having depending hangers, a shaft mounted thereon, a wind-wheel connected with the shaft, a casing surrounding the wheel, a damper on the casing, a clutch on the shaft, means within the car for operating the clutch, and adjusting the damper, and a dynamo having its shaft operated by that of the wind-wheel.

METHOD OF ELECTROLYTICALLY TREATING STRAW OR OTHER FIBROUS MATERIAL. G. H. Pond, Ashburnham, Mass., 616,139. Filed July 9, 1897. A method of treating fibrous material for the manufacture of paper pulp by electrolytically decomposing a solution of chlorid of sodium in the presence of calcium hydrate and then subjecting the material to the action of the resultant solution.

CARBON FOR ELECTRIC WELDING. G. W. De Tunzelmann, London, England, 616,165. Filed Feb. 25, 1898. An electrode for electric welding, brazing, etc., composed of carbon and metallic oxides combined together by admixture.

ELECTRIC VOTING MACHINE. F. S. Wood, Boston, Mass., 616,174. Filed Jan. 16, 1897. Details of construction.

ELECTRIC OPERATION OF ELEVATORS BY THREE BUTTON PUSH SYSTEM. John D. Ihlder, Yonkers, N. Y., assignor to Otis Bros. & Co., same place, 616,190. Filed Dec. 16, 1897. Combines a motor and a reversing switch controlling the motor, with a circuit, including two sets of push buttons, circuit maintaining magnets, and non-interfering magnets controlling the circuit.

ELECTRICALLY OPERATED REGULATOR FOR DAMPERS, ETC. George F. Richardson, Hartford, Conn., 616,358. Filed April 15, 1898. Details of construction.

COIN-FREED APPARATUS FOR GENERATING X-RAYS. Maurice Vidal, Paris, France, 616,375. Filed Oct. 27, 1897. Details of construction.

ELECTRICALLY WELDED JOINT. R. Eyre and W. Disborg, Johnstown, Pa., assignors by mesne assignments to the Lorain Steel Co., of Ohio, 616,435. Filed Feb. 7, 1898. Details of construction.

ELECTRIC WELDING. H. F. A. Kleinschmidt, Johnstown, Pa., assignor to the Lorain Steel Co., of Ohio, 616,436. Filed Feb. 7, 1898. Details of process.

ELECTRIC WELDING. Henry F. A. Kleinschmidt, Johnstown, Pa., assignor by direct and mesne assignments to the Lorain Steel Co., Ohio, 616,436. Filed Feb. 7, 1898. Especially applicable for welding splice bars to rails for the construction of "continuous railway track."

Railways and Appliances:—

RAILWAY SWITCH. E. S. Leaycroft, Jersey City, N. J., 616,120. Filed Feb. 3, 1898. The movement of the switch tongue is effected by means of an armature carried on the car.

RAIL BOND. Walter E. Harrington, Camden, N. J., 616,232. Filed April 9, 1898. Consists of a bond having a smooth contacting surface adapted to contact with the abutting ends of the rails beneath the fish plate and setscrews to maintain it in position.

SYSTEM OF ELECTRIC TRACTION. Michelangelo Cattori, Rome, Italy, 616,403. Filed Dec. 24, 1897. Turnout for electric railways constituting an automatic block system.

Switches, Cut-Outs Rheostats, Etc.:—

ELECTRIC SWITCH. William J. Kelly, Boston, Mass., 616,110. Filed May 1, 1897. Comprises a rotatable shaft, a plurality of commutators loosely mounted thereon, operating handles for the commutators, clutch mechanisms to couple the operating handles with commutators, and locking devices for the handles to render them fast to the shaft.

MAGNETIC SWITCH. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Co., Chicago, Ill., 616,148. Filed Dec. 23, 1897. Comprises a base having a socket for a plug formed in it, a movable armature and switch contacts, controlled thereby near the socket, a plug and a mass of magnetic material associated therewith, the mass of magnetic material or armature being magnetized, whereby the armature is moved when the plug is in its socket.

AUTOMATIC MAGNETIC CIRCUIT BREAKER. Charles M. Clark, New York, N. Y., 616,405. Filed May 27, 1898. Designed for use on single, two-wire or multiple circuits. Details of construction.

Telegraphs:—

TELEGRAPH REPEATER. F. W. Cole, Newton, Mass., 616,222. Filed Aug. 5, 1893. Details of construction.

Telephones:—

MICROPHONE FOR CONTAINING GRANULAR CARBON FOR RETAINING MATERIAL IN POSITION. L. M. Ericsson, Stockholm, Sweden, 616,186. Filed April 6, 1898. Details of construction.

General Trade in the West.

The general trade throughout the West and Southwest is reported by the Western Electrical Supply Co., of St. Louis, as having been unprecedented for this season of the year. They note excellent sales for the Moloney transformer, for which they are general Western agents, and state that the lighting companies using the Moloney transformer, after subjecting them to the most severe tests, have reported most gratifying results. They also report the usual, steady and increasing demand for their Monarch lamp, which they claim is giving universal satisfaction generally throughout the West.

HOTEL HAMILTON, Island of Bermuda, has just placed in operation a direct connected lighting plant, consisting of a Westinghouse generator direct connected to an engine built by the Ball Engine Co., Erie, Pa.

CATALOGUES.

A Bird's Eye View of the Westinghouse Machine Co.'s Business.

This is the title of a very handsome little brochure issued by the Westinghouse Machine Company, Pittsburg and Chicago, which illustrates and describes in a very unique manner all the apparatus manufactured and sold by that company. It is a brief but comprehensive index to the character and the extent of their business and shows that they are equipped to meet every requirement of the power user. It tells the reader that they build steam and gas engines, mechanical stokers and ice-making and refrigerating machinery, and that they design and install steam boilers, electric and refrigerating plants, economizers, mechanical draught, steam loop systems and high class piping. Besides, however, enumerating the above, several types of each class of apparatus are illustrated, and also some descriptive matter is added about several of the plants where they have been installed. It is a splendid production, and will be sent to any one on application. Another more exhaustive catalogue, entitled "The Westinghouse Compound Engine," has also recently been issued and contains ninety-three pages of very interesting and instructive text on the Westinghouse engines in particular and compound steam engines in general. It is a handsomely printed, profusely illustrated catalogue, and equals in every way the splendid typographical productions of the Westinghouse companies within recent years.

Chicago Rheostats.

The Chicago Rheostat Company, of Chicago, of which Mr. E. W. Hamill is general manager, have just issued a very handsome, useful and complete catalogue of rheostats which they manufacture. These rheostats, which have been on the market for some time, are well known for their reliability, finish and general excellence. They are the result of years of experience in the manufacture of this line of products, and represent the most advanced engineering practice. Features have been introduced into this catalogue which render it very convenient for reference, and the use of a large amount of descriptive matter has been avoided, as the company believe that the study of the art is such that minute descriptions are unnecessary. Opposite the illustration of each type has been placed a short and concise description and the price lists are so arranged that the prices of the various starting devices for a motor are thrown together. Each price list is accompanied by dimensions, diagrams and instructions, furnishing to the engineer or purchasing agent complete information. The catalogue will be sent to any one on application.

Sparks from the Crescent Anvil.

This is the very striking heading of a creditable pamphlet issued by the Sparks Publishing Department, 242-244 First avenue, Pittsburg, Pa., and sets forth most prominently the good qualities of Cresecent die steel. The paper contains splendid article on furnaces, centering, car springs, tempering saws, placing castings, tempering recipes, lead heating, structure of steel hardening punches, dies, resin, etc. It also speaks about the "school of hardening" which is located at Pittston, Pa., and is conducted by Mr. W. S. Casterlin. There is also advertised the souvenir booklet entitled "Steel Making," issued by the Crescent Steel Company, Pittsburg, Pa.

Chloride Accumulators for Automobiles.

A very complete and useful catalogue on this subject has recently been issued by the Electric Storage Battery Company. Drexel Building, Philadelphia, Pa., and is called by them catalogue 5, first edition, 1898. It illustrates a special type of battery designed for electric vehicles which has been installed on a large scale by the Electric Vehicle Company, New York, and the Pope Manufacturing Company, Hartford, Conn. The containing jars of the various sizes of these cells are made as light

Digitized by Google

is consistent with the requirements of this service, and the cells have a long life and high efficiency. The company will be glad to send this catalogue to any one applying for it and to furnish information on this subject.

James Beggs & Company's New Boiler.

A special catalogue of steam boilers and engines has just been issued by the well-known firm of James Beggs & Company, 9 Dey street, New York, illustrating their improved steam engines, stationary boilers, foundry cupolas, coal buckets, tanks, smokestacks and other iron or steel work of any description. Special attention is directed to the new direct return or improved horizontal return tubular steam boiler fitted with the best and most enduring grate bars. This new boiler, which is said to occupy less space than other boilers of equal capacity, is now on exhibition at the company's store, and it is well worth the time of engineers to thoroughly inspect it. The catalogue, which measures 9 by 12 inches and contains fifty-two pages, will be sent to any one on application.

Dies and Die Making.

This is the name of a very complete text-book on the above subject by Mr. J. L. Lucas, and is free from the customary attributes of advertising matter. It deals in a most thorough manner with the subject which forms the title of the book, and contains a number of instructive articles which have previously been published in the columns of the "American Machinist." The book must certainly be a great help to machinists and others who have use for dies and die making machinery.

CENTRAL ELECTRIC COMPANY are in receipt of a great many flattering comments from the trade on their new general catalogue, of which the following is a sample: "We beg to acknowledge the receipt of a copy of your new general catalogue, and thank you for the same. It is a very complete and fine production in every respect. Kindly send discount sheet." As the catalogue contains a quantity of valuable data, outside of the merchandise illustrated, it is well worthy of careful examination and preservation.

TRADE NOTES AND NOVELTIES

Apparatus Wanted.

Mr. A. H. Frazer, of Kahoka, Mo., former owner of the electric light plant of that city, would like to correspond with parties for a 300 light 110 volt dynamo, engine and boiler.

Beacon Series Lamps.

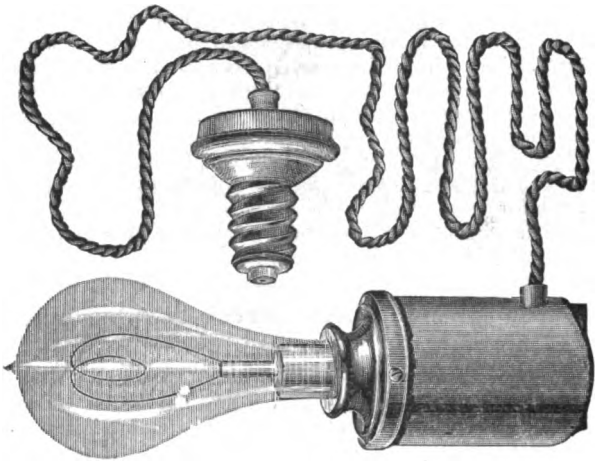
The Beacon Lamp Company, New Brunswick, N. J., report a remarkably large sale of their well known series incandescent lamp. These lamps are manufactured by a new process and retain their brilliancy and candle power for a long time. It is claimed that they show less blackening than any other lamp by at least 75 per cent. The lamps are made for all standard amperages, of from 10 to 150 volts, with any kind of base. The company have lately received numerous foreign orders, and a large order from Boston where their lamps were being tested in competition with other makes. The company invite correspondence on the subject of lamps and will cheerfully send samples to anyone desirous of testing them or comparing them with those of other manufacturers.

Magnetic Incandescent Lamp Holder.

IT has been said that "there is nothing new under the sun" in incandescent lamp sockets, but it seems from the illustration herewith that the explorers and inventors in that field left a very interesting territory unexplored. The holders are placed on the market by Jenkins Bros., New York, Boston, Chicago and Philadelphia, and for use where direct current is available. Being a magnet they will adhere to any piece of iron or steel in any position. They are useful in machine shops, as they can be so placed as to have the light shine exactly where wanted when working with lathe, planer, drill and other tools.

In boiler shops their use does away with torches, as it can be carried inside the boiler. In railroad shops it is particularly useful when repairing locomotives, as its position may be changed at will, and it will be found useful in many other ways about the shop.

There are many places where a portable magnetic holder will



MAGNETIC INCANDESCENT LAMP HOLDER.

be found useful, viz., in engine and boiler rooms, aboard steamships and steamboats; about elevators when making repairs; in mines, basements, cellars, bank vaults; in fact, all places where light is needed.

It is made for Edison, Westinghouse and Thomson-Houston lamps, and is sold for $1.50.

The "Provo" Type High Potential Insulator.

THE Hemingray Glass Company of Covington, Ky., is placing on the market the "Provo" type insulator for high potential work. This is the insulator which has given such excellent results on the 40,00 volt line of the Telluride Power Transmission Company in Utah. The insulator was perfected nearly a year and a half ago, and is the outcome of several years of experiment with existing types and many new forms. It is only now that a description appears in print, as it has been the desire of the makers to fully establish its worth. It is all glass, which is the cheapest insulating material, and is boldly claimed to be the only one that is absolutely reliable when exposed to the weather and the action of high potential currents.

It is 5¾ inches high and 7 inches in diameter and has five

THE "PROVO" TYPE HIGH POTENTIAL INSULATOR.

petticoats. Two of these petticoats are near the line wire and serve to break the continuity of the exposed surface between the wire and the pin or the cross arm, which tends to prevent jumping of the current between these points. Another advantage of these petticoats near the line wire is that they protect surfaces of small area and high resistance, which check surface leakage at its source. It is noticed in actual practice that these surfaces

Digitized by Google

remain free from moisture and snow. The other petticoats on the bottom extend the surface distance from the line wire to the pin to 16 inches. Teats along the bottom of the outer petticoat aid in shedding water.

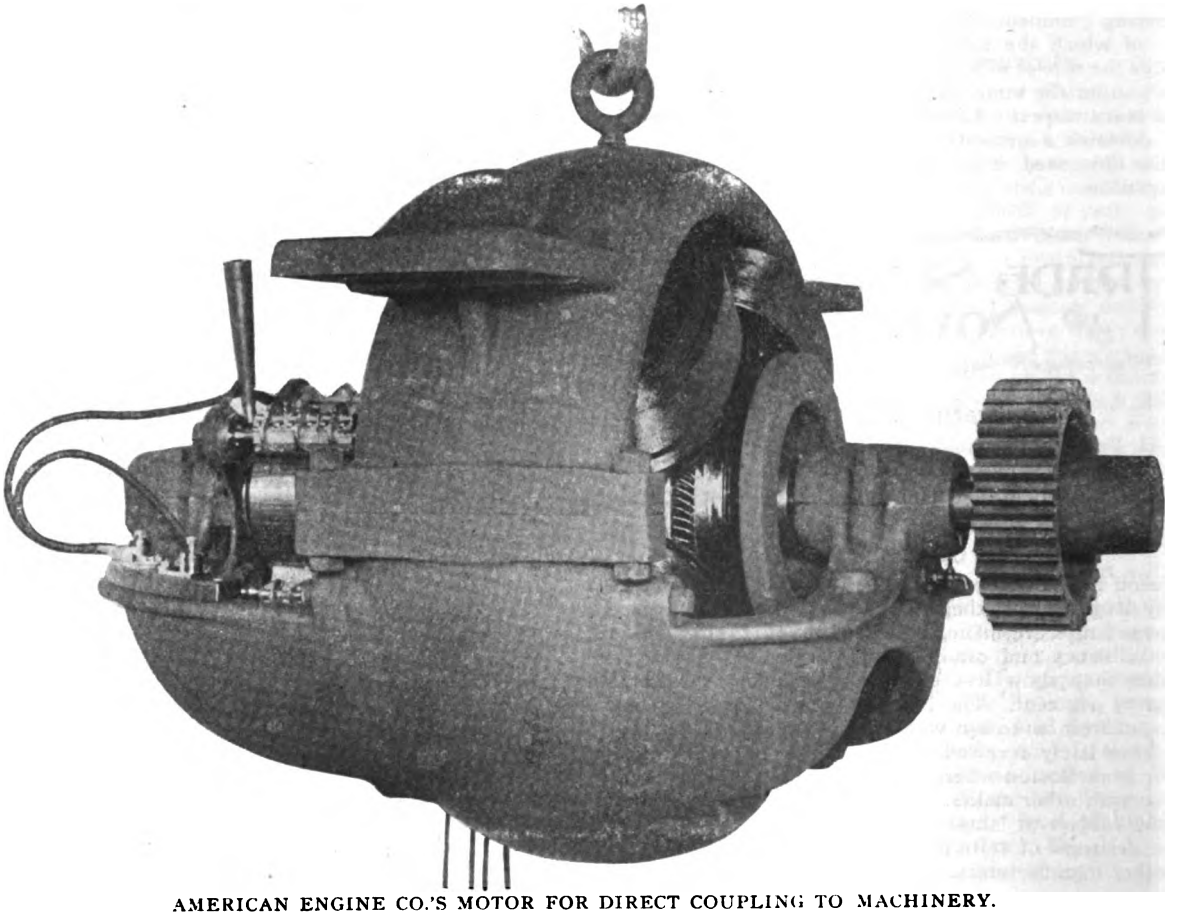
The line wire is tied around the insulator in the topmost groove, which holds it well above the cross arm. This method of tying has been adopted, as it is considered the best for use in a country where the strain on an insulator may be either up or down or sidewise.

The thickness of glass is well proportioned and the insulator is extra strong in resisting mechanical breakage or electrical punctures. Tests have been made between the points for the wire and the pin with voltages as high as 125,000 without puncturing the material. The thread is of standard size and 2½ inches long. The strain of the wire comes squarely on the pin. The glass is almost colorless and the insulator is not conspicuous on a pole line. The name of Hemingray is a sufficient guarantee for good work in the glass insulator line. They have increased facilities for manufacturing this insulator and are prepared to fill orders on short notice.

American Engine Co.s Direct-Coupled Electric Motors.

THE many advantages possessed by all classes of machinery driven direct by electric motors and the saving effected by such combinations, have been so clearly demonstrated within recent years that a new industry, consisting of the manufacture of a type of motor suited to such requirements has been developed. One of the first companies in this field and one whose products have met with well-merited success, is the American Engine Co., of Bound Brook, N. J., the manufacturers of the well-known American-Ball engines, generators and motors. The illustration represents their latest production, a new direct-coupled electric motor. These motors are specially adapted to direct-connected driving of large web printing presses and other heavy machinery, where great power is required to start the machine and where a wide range of speed is desirable. By a special arrangement peculiar to these motors, the starting force or torque is greatest at the maximum speed, thus reversing the usual conditions and providing double starting torque. Another feature of great importance is the wide range of speed, under perfect control, covering all speeds from five per cent. to the maximum. This gives perfect control through a range of 95 per cent., with the turning force or torque greatest at the minimum speed. The lugs shown near the top of the figure, and which are cast as part of the frame, rest upon steel beams which support the machine in position. These lugs may be omitted and a base provided for the machine to rest upon. In each case the machine is supported in that position which is most convenient and best suited to the place that it has to occupy. The company have also designed a special rheostat, or regulating starting box and switchboard used in the operation of their direct-connected electric motor. This rheostat controls the current in the armaturre and also in the auxiliary field. The primary or normal field is always in circuit, and is not interrupted or manipulated in any manner, so that the maximum speed (which is determined by this field) cannot exceed the normal speed. This prevents any possible accident by excessive speed. The minimum speed is obtained by regulating the current in the auxiliary field, and in the armature, and when running at five per cent. of the normal speed the torque is nearly double the normal amount, so that a heavy press can be easily and safely started and controlled by a motor having a normal capacity to drive the press when in motion. The switchboard accompanying the rheostat has all the instruments necessary to the operation of the motor, and also an automatic circuit breaker.

The company will be pleased to furnish any further information about these motors and send catalogue and estimates on application.



AMERICAN ENGINE CO.'S MOTOR FOR DIRECT COUPLING TO MACHINERY.

The particular motor from which this cut was made has been furnished to the Pittsburg "Dispatch," and the "feet" of the motor were located near the top because the surrounding conditions made it necessary for its special application.

MR. W. M. MORDEY notifies his American friends of a change of address from 66 Victoria street, London, to 82 Victoria street, Grosvenor Mansions, Westminster, where he will carry on his practice as a consulting electrical engineer.

Digitized by Google

Big Wagner Transformers for Niagara.

THE developments at Niagara are requiring a great deal of apparatus, much of which is of a special and unusual nature, and great interest is manifested in the successive contracts made for such machinery. We note with pleasure another big contract of this kind just awarded. The Wagner Electric Mfg. Co., through its manager of sales, Mr. E. H. Aberdie, has secured the largest transformer order ever placed in this country. The magnitude of the order itself is not only a surprising condition, but further than this the horse power capacity of the units is 800 h. p. larger than any other transformers installed in this country to date. The contract in detail was placed by the Union Carbide Co., for its carbide works at Niagara Falls, N. Y., for seven static transformers of 2,000 h. p. output capacity each, and two static transformers of 500 h. p. output capacity each, complete with switchboards for operating them.

The transformers are to be of the oil-filled type of apparatus, with water coils for lowering the temperature of the oil. The contract was closed on definite specifications as to iron and copper losses, full, ¾, ½, ¼ and 1-10 load efficiency, guaranteed as to temperature rise, also as to insulation testing, and guarantees made as to 50 per cent. overload in current. This equipment complete was purchased from the Wagner Electric Mfg. Co., of St. Louis. As the electrical apparatus installed by the Union Carbide Co. is subject to the approval of the Great Niagara Falls Power Co., and as Mr. Stilwell, the managing director, has given his approval of the specifications agreed upon, it will be seen that the Wagner Co. is recognized by all as capable of undertaking and successfully completing any installation that seems feasible in the minds of their engineers. We have to congratulate them on their success in this connection.

By securing this order, the Wagner Co. have established a record as builders of the largest power transmission transformers in the world, which, combined with their 40,000 volt high tension transformers which are now operating at Provo, Utah, and Telluride, Colo., places them in the van as leading the world in the building of the largest single unit transformers, and for the highest voltage. We wish the Wagner Co. continued success in their work, and compliment them on their untiring efforts which have resulted in such advancement in a short period of nine years.

The Wagner Co. are getting some very large orders in high potential transmission transformers, where the units range from 100 to 500 horse power, and the high tension voltage as high as 40,000 volts.

NEW YORK NOTES.

MR. C. A. CROSELMIRE. We are glad to note the return of Mr. C. A. Croselmire from a trip abroad. During his trip he has made large business arrangements, and purchases of crude platinum ore, of which he is one of the largest refiners in this country. This firm has been known for years for the standard of excellence of the pure platinum which it sells to the trade. During the past year it has institued processes in manufacturing the goods whereby the percentage of platinum extracted from the crude article yields a larger percentage than, it is claimed, possibly any other firm in the business has been able to accomplish heretofore. This enables Mr. Croselmire to offer refined platinum at as low a figure as it can be bought at anywhere. Mr. Croselmire will be pleased to quote prices and give information regarding platinum to any concern in the market for their goods.

MR. HERBERT B. COHO, New York manager of the Eddy Electric Mfg. Company, announces the following sales during the past week: Nairn Linoleum Works, one 150 k. w. and one 25 k. w. generator; U. S. Galvanizing Company, two 1,400 ampere platers; Bethlehem Silk Company, one 50 k. w. lighting machine; J. L. Moriarty, 300 light dynamo and gas engine; Geo. F. Blake Mfg. Company, Knowles Steam Pump Co., motors for pumps; Brill Brothers, Wolfstein & Horwitz, small power plants. The new offices of the Eddy Electric Mfg. Co., at 143 Liberty street, are always open from eight in the morning until six at night, and anybody desiring estimates is cordially invited to call.

MR. ALBERT H. WALKER has recently moved his patent law office from Hartford, Conn., to 100 Broadway, New York, where he will continue his practice of twenty-one years' standing in the treatment of all such matters. He retains his non-resident lectureships in Cornell University and the University of Michigan.

MR. ALBERT JOHNSON, president of the Nassau Electric Railroad, Brooklyn, has returned from Europe in order to give attention to his local interests. He hopes to do something in London yet, and says that "no city in the world can compare with London as a trolley town."

MR. H. L. SHIPPY has been elected a director and vice-president of the New York Electrical Exhibition Company, vice Mr. F. W. Roebling, resigned.

NEW ENGLAND NOTES

THE CROCKER ELECTRIC CO., of Bridgeport, Conn., sale agents for New England switches, and dealers in general electrical supplies, are sending agents through the Eastern and Middle States and are building up an excellent business. They will soon move into much larger quarters.

WINSTED, CONN. Decker & St. Clair, the general contractors for the new church in Winsted, Conn., have let the contract for furnishing the structural iron work in the building to the Berlin Iron Bridge Co., of East Berlin, Conn.

RUSSELL-TOMLINSON ELEC. CO. has been formed at Shelton, Conn., with a capital stock of $20,000, of which $17,000 has been subscribed; to make and deal in electrical supplies, etc. The incorporators are G. G. Milne and C. B. Barker, New York City; W. W. Tomlinson, Shelton, and W. E. Russell, Danbury.

HON. GEO. O. PROCTOR, president of the Anchor Electric Co., of Boston, was elected mayor of Somerville, Mass., by a very large majority at the recent municipal election.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., are erecting for the Waterbury Mfg. Co., Waterbury, Conn., a new blacksmith shop, two stories high. The building is to be of fireproof construction throughout. The floor consists of concrete on corrugated iron arches, carried by steel beams and columns. The roof has steel trusses supporting the covering of corrugated iron lined with the Berlin patent anti-condensation lining. The building is about 40 feet square.

SWETT & LEWIS CO., 11 Bromfield street, Boston, will soon have on the market a new and improved static machine which, it is claimed, will be superior to any heretofore manufactured. They report a satisfactory trade throughout their line of X-ray apparatus.

WESTERN NOTES

THE LORICATED IRON ARMORED CONDUIT, which is handled extensively throughout the West by the Western Electrical Supply Co., of St. Louis, Mo., is reported by them to be steadily advancing in favor, until they are now able to state that their business in this line has increased to a very satisfactory basis, which they consider a very flattering indorsement of the merits of this product. The Western Electrical Supply Co. carry, we understand, a very large and well assorted stock of this conduit in St. Louis, and are making prompt shipments of same.

THE ELECTRIC APPLIANCE CO. have for distribution to the telephone trade a sample card of such of their celebrated Paranite wires as are particularly adapted to telephone uses. The card shows samples of No. 19 plain and braided single conductor Paranite of a high insulation suitable for telephone work. It also shows samples of No. 19 duplex twisted Paranite wire in three styles, the first being plain with one conductor of red rubber and the other with black rubber insulation; another sample with black and red rubber insulation but braided over with a regular saturated weatherproof braid. There is still another sample of the No. 19 2-conductor twisted having red and black rubber insulation, but having glazed braid instead of the saturated braid. These sample cards can be had for the asking.

Digitized by Google

VICTOR TELEPHONE MFG. CO., 166-174 South Clinton street, Chicago, have just sold to the Chequamegon Telephone Co., of Ashland, Wis., a full 400 number exchange, including everything in the way of telephone equipment. This is another addition to an already long list of large equipments, and the company propose to make the plant as usual a model.

PINE BLUFF, ARK., COTTON OIL CO. has recently installed a 70 h. p. engine, built by the Ball Engine Co., Erie, Pa.

THE ELECTRIC APPLIANCE CO. are calling particular attention to the Jenkins switch, which is the latest arrival in the field of snap switches. The Electric Appliance Company claim that they are in a position to sell these switches at a very much lower figure than has ever been offered before on a first-class article. They solicit an opportunity to quote prices to all users of snap switches.

INDIANAPOLIS, IND. Daniel A. Chenoweth, promoter of the Chenoweth Light and Power Company, has filed with the Board of Public Works an application for a franchise for the company and a bond of $25,000, secured by Samuel A. Chenoweth, Anthony Harmon and William W. Spencer. A plan of overhead wires outside of the "mile square" was also filed. The company will cater only for that part of the city outlying the territory bounded by North, West, South and East streets.

SOUTHERN NOTES

CARTER-HAYS ELEC. CO., recently incorporated at Louisville, Ky., are successors to L. D. Carter, 237 Fifth street, that city. Mr. L. D. Carter, M. E., is president of the new company, and C. B. Hays, secretary and treasurer. They do a general construction business, handle all kinds of supplies, and have installed some of the largest isolated plants in their city and vicinity. They are agents for the Bullock dynamo and motors.

FOREIGN NOTES

ELECTRICITY IN SAXONY. Consul Winter notes that no fewer than five electro-technical factories have been started in Saxony this year, with a total capital of over $2,000,000.

MR. ALFRED J. THOMPSON, of Havana, Cuba, has come up to New York for the Christmas holidays, and as a bracer after the dose of yellow fever he got last summer. He says there is a bright outlook for electrical goods in the island and for improved trade in general.

MR. FRANCIS E. DRAKE, commissioner for electrical and machinery exhibits at the Paris Exposition of 1900, whose article on that subject appeared in this journal last week, has been visiting New York, and finds the outlook very hopeful for a fine display. The limitations as to space, however, are likely to prove seriously cramping on the more ambitious exhibitors.

HAVANA, CUBA, is to have a trolley system, as already noted, and the latest step is the sale of the Ferro Carril Urbano, half to English capital and half to Mr. G. W. Young, president of the U. S. Mortgage and Trust Co., Senator Smith of New Jersey, P. Farquhar, F. S. Pearson, Col. G. B. M. Harvey, and Hanson Bros. of Montreal. Mr. Pearson, who is said to represent Whitney interests, has gone to Havana. There is a big struggle going on for trolley control in Havana.

PHILADELPHIA NOTES

PHOSPHOR-BRONZE SMELTING CO., 2200 Washington avenue, Philadelphia, have, owing to the high prices of copper, tin, etc., withdrawn all quotations on phosphor-bronze, delta metal and other alloys, etc. They will be glad to quote prices and receive orders.

WASHINGTON, PA. The Washington Electric Light & Power Co., Washington, Pa., have recently increased the capacity of their station by the addition of a 175 h. p. engine built by the Ball Engine Co., Erie, Pa.

CONTENTS.

EDITORIALS:
Electric Versus Cable Traction 642
Municipal Conservatism in England 642
Bears and Horses 643
Lack of Engineer Troops 643

MISCELLANEOUS:
Practical Balancing of Armatures (illustr.)....George T. Hanchett. 633
The Necessity for a Naval Electrical Engineer Corps..F. W. Roller. 634
A Wrinkle in Electric Gas Lighting (illustr.).....J. R. Cravath. 635

POWER TRANSMISSION:
The Development of Niagara Power in Canada (illustr.)..... Orrin E. Dunlap. 636

ELECTRIC LIGHTING:
The Mechanical Plant of a Modern Commercial Building—IV. (concluded).....William H. Bryan. 637
Incandescent Lamps and Welsbachs 640

ROENTGEN RAYS:
Polarization of Electric Radiation.—Duration of Roentgen Ray Emission.—Vacuum Tubes vs. Coherers.—Difference Between Roentgen and Cathode Rays 640
Currents Generated by Roentgen Rays 641

LITERATURE:
Thompson's "Michael Faraday: His Life and Work."—Shillitto's "Handbook of Corliss Steam Engines."—Abbott's "Electrical Transmission of Energy."—The Purdue Exponent 641

TELEPHONY AND TELEGRAPHY:
The Fleming Plan for Imperial Cables.—What the Bell Telephone Co. Owns.—Telephone "Alarm Clocks" at McKeesport, Pa.—Independent Telephone Lines in the West.—The Ries Telephone System 644
Competitive Telephony for Cincinnati, Ohio 645

MUNICIPAL AFFAIRS:
Electric Power Companies and Their Relation to Municipalities.. A. E. Lang. 645

ELECTRIC TRANSPORTATION:
Lake Submarine Boat "Argonaut" (illustr.)..... 647
A Three-Phase Inclined Plane Road, Mont-Dore, France (illustr.). 648
Practical Points in Street Railway Engineering....W. A. Harding. 649
Electric Automobiles on Fifth Avenue, New York City..... 649
The Safety Third-Rail Electric System at Work at Manhattan Beach, New York.—An American Railway Map for the Paris Exposition. 650

NEWS AND NOTES:
Lightning and Lightning Arresters 650
Torpedo Militia .....Col. Eugene Griffin. 650
Lighting Affairs in Brooklyn.—Exports of Electrical Material from New York 651
General Trade in the West 656

MECHANICAL:
The Influence of Mechanical Draft Upon the Operating Expense of a Steam Boiler Plant.....W. B. Snow. 651

PATENT NOTES:
A Valuable Electrical Invention 652

SOCIETY AND CLUB NOTES:
Chicago Electrical Association and "Wireless Telegraphy."—Virginia Street Railway Association.—Northwestern Electrical Association 653

OBITUARY:
Ronald T. McDonald.—Dr. Wellington Adams 653
Frederick C. Whitmore 654

LEGAL NOTES:
Tesla Polyphase Patents Declared Invalid in Germany. 643

EDUCATIONAL:
More Gifts to McGill University 643

THE STOCK MARKET:
Some Commercial and Financial Conditions..... 654

REPORTS OF COMPANIES:
Sale of the Wenstrom Co., of Baltimore.—Pelton Engineering Co., Cleveland, Ohio.—Fort Wayne Lamp Co..... 654

INVENTORS' RECORD:
Classified Digest of U. S. Electrical Patents, Issued Dec. 13, 1898. 655
Classified Digest of U. S. Electrical Patents, Issued Dec. 20, 1898. 655

CATALOGUES:
A Bird's-Eye View of the Westinghouse Co.'s Machine Business.—Chicago Rheostats.—Sparks from the Crescent Anvil.—Chloride Accumulators for Automobiles 656
James Beggs & Co.'s New Boilers.—Dies and Die Making.—Central Electric Co. 657

TRADE NOTES AND NOVELTIES:
Apparatus Wanted.—Beacon Series Lamps.—Magnetic Incandescent Lamp Holder (illustr.).—The "Provo" Type Insulator (illustr.)... 657
The American Engine Co.'s Direct Coupled Electric Motors (illustr.) 658
Big Wagner Transformers for Niagara.—New York Notes.—New England Notes.—Western Notes 659
Southern Notes.—Foreign Notes.—Philadelphia Notes..... 660

Department News Items will be found in advertising pages.

Digitized by Google

THE "CLARK" WIRE.

FOR SWITCHBOARD, RAILWAY and MOTOR USE.

All sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

Inspector Boston Fire Underwriters' Union says:
"A thoroughly reliable and desirable wire in every respect."

The Clark wire has been before the public and in use for the past ten years, and has met with universal favor. We guarantee our insulation wherever used. Aerial, Underground or Submarine, and our net prices are as low, if not lower than any other first-class insulated wire. We shall be pleased to mail Catalogues, with terms and discounts for quantities.

EASTERN ELECTRIC CABLE COMPANY,

HENRY A. CLARK, Treas. and Gen'l Manager.
HERBERT H. EUSTIS, Pres. and Electrician.
61-63 Hampshire Street, BOSTON, MASS.

FIBRE PAPER RUBBER **CABLES AND** HIGH GRADE RUBBER COVERED AND WEATHERPROOF **WIRES,**

Conduits and Accessories, For Telephone, Telegraph, Electric Light and Power.

STANDARD UNDERGROUND CABLE COMPANY,

Pittsburg: Westinghouse Bldg.
New York: 18 Cortlandt St.
Philadelphia: 1225 Betz Bldg.
Chicago: 542 The Rookery.
St. Louis: 507 Security Bldg.

SPECIALISTS IN THE DIRECT CONNECTION OF ELECTRIC MOTORS To all classes of Light Machinery. Manufacturers of DESK, CEILING, FAN AND POWER MOTORS, also MOTORS for Sewing Machines, Pumps, Organ Blowers, Laboratory Work, and all Special Purposes, KNIFE SWITCHES, SWITCHBOARDS, etc. We make over 100 kinds of A. C. Motors, from 1-30 to 3 H. P. **THE EMERSON ELECTRIC MFG. CO.,** 714-716-718 ST. CHARLES ST. ST. LOUIS, MO.

WM. A. ROSENBAUM

Electrical Expert and Patent Solicitor.

ROOM 177, TIMES BUILDING. NEW YORK CITY.

Transformers,

Kuhlman Electric Co

ELKHART, INDIANA.

GOLD STREET CAR HEATING CO.,

Frankfort and Cliff Sts., NEW YORK CITY. 658 Rookery, CHICAGO, ILL.

We are now constructing and selling the most Improved Electric Heaters on the market.—Our heaters combine the highest efficiency with the greatest economy.—They are the acme of simplicity. We guarantee their durability—acknowledged everywhere to be without equal.

MANUFACTURERS.

Selling price and cost of production are very interesting commercial quantities. Your profit is the difference between them.

It requires commercial ability to raise prices to the value for maximum profit. That you have done.

It requires engineering ability, a knowledge of materials and methods of manufacture, to force down the cost of production.

Are you sure that you are not paying too much for your goods? If you were a commission merchant you would be looking sharply after this. Can you afford to do less as a manufacturer?

Money has been saved before by expert design. My services may be valuable to you.

GEORGE T. HANCHETT,

Electrical and Mechanical Engineer
123 LIBERTY ST., NEW YORK CITY.
Electrical and Mechanical Design.

C. S. KNOWLES

HARD RUBBER ROD, TUBE,

TURNED AND MOULDED WORK

GET OUR PRICES.

NEW YORK. BOSTON.

DIRTY OIL

can be purified perfectly, and used over and over again, by using the celebrated

Tracy Oil Filter.

Standard, reliable and perfect. Saves oil consumers 75%.

PHŒNIX AUTOMATIC FILTER CO., RACINE, WIS.

WEATHERPROOF WIRE.

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

AGENCIES:

WESTERN ELECTRIC CO., New York.
ELECTRIC APPLIANCE CO., Chicago.
PETTINGELL ANDREWS CO., Boston.
ELECTRICAL ENGINEERING CO., Minneapolis.
ST. LOUIS ELECTRICAL SUPPLY CO., St. Louis.
THE BRADFORD BELTING CO., Cincinnati.

Phillips Insulated Wire Co.,

Office and Factory: PAWTUCKET, R. I.

THEATRE DIMMERS

WARD LEONARD ELECTRIC CO.
Bronxville, N. Y., U. S. A.

HENRY C. TOWNSEND, *Formerly Principal Examiner, Electrical Division, U. S. Patent Office.*
DELBERT H. DECKER, *Late Assistant Examiner, Electrical Division, U. S. Patent Office.*

TOWNSEND & DECKER,

Solicitors of U. S. and Foreign Patents,

Expert opinions upon the scope and validity of patents. 5 BEEKMAN ST., (Temple Court). New York.

RESISTANCE RODS

of graphite. New process. Complete with metal terminals. Cheap and accurate. Resistance 50 to 5,000 ohms. Size and capacity as required by user. Thousands in use by largest telephone companies.

E. W. JEWELL,
521 Wabash Avenue - Chicago.

STORAGE BATTERIES

Rented, Recharged, Repaired.
Stored Electric Power Supplied.
Portable Electric Lanterns. Carriage Lamps.
YACHT LIGHTING A SPECIALTY.

THE STORAGE BATTERY SUPPLY CO.
239 East 27th Street, New York.

Albert B. Herrick

CONSULTING ELECTRICAL ENGINEER
AND ADVISORY EXPERT

On Central Station and Power Station Construction: Their Economical Operation and Testing.

Sole Owner of the Herrick System of Electrical Inspection of Car Equipments.

Tel. 2059 Cortlandt *120 Liberty Street*
Cable "Albertria" *N. Y. CITY*

"American" Storage Cells are the best. Send for descriptive circular. ABSOLUTELY NON-INFRINGING. PROTECTION GUARANTEED.

AMERICAN BATTERY CO.,
ESTD 1888 172 So. Clinton St., Chicago, Ill.

William H. Bryan, M. E.,
H. H. Humphrey, M. S.,

MECHANICAL AND ELECTRICAL ENGINEERS.
Consultations, Reports, Estimates, Plans, Specifications, Superintendence, Tests, Purchasing. Designs of Central Stations a Specialty.

Turner Building, St. Louis.

SHEAFF & JAASTAD,

Mechanical and Electrical Engineers.

Plans and specifications for and superintendence of Electric Power and Lighting Plants a specialty.

85 Water St., BOSTON, MASS.

J. G. WHITE & COMPANY,

INCORPORATED.

ENGINEERS CONTRACTORS.

29 BROADWAY, NEW YORK, N. Y.

EQUITABLE BLDG., BALTIMORE.

Digitized by Google

Wanted, For Sale and Bargains.

BARGAINS IN DYNAMOS, ENGINES, ETC.

DIRECT CURRENT DYNAMOS, ALTERNATING CURRENT DYNAMOS, ARC DYNAMOS, ENGINES, BOILERS, HEATERS, PUMPS. This apparatus has been removed from our own Central Stations to make room for larger units. We therefore know its history and can guarantee it to be in thoroughly good operative condition. Write us for Price List No. 26.

CHICAGO EDISON COMPANY, 139 Adams Street, Chicago

WANTED FOR SPOT CASH.

OLD INCANDESCENT LAMP BASES WITH OR WITHOUT PLATINUM.
FREIGHT PAID AND HIGHEST PRICES GUARANTEED.
GEO. F. SCHWALM, - HARRISON, N. J.

WE BUY, SELL AND EXCHANGE.

BARGAINS.

Second-hand Dynamos, Motors, Arc Lamps, Transformers.

REPAIRING

Armatures, Commutators, Fields, Arc Lamps and Transformers.

CASS & AARON CO.,
141 S. CLINTON ST., CHICAGO.

REWINDING.

Motor Starting Rheostats
Motor Regulating Rheostats
Dynamo Field Rheostats
Theatre Dimmers, Special Rheostats.

Iron Clad Resistance Co.
WESTFIELD, N. J., U. S. A.

AGENCY WANTED.

Would like to correspond with manufacturer who has an article he desires to place upon the market in Greater New York. Have extensive acquaintances among various branches of electrical trade, including supply houses, dynamo manfacturers, electrical repair shops, lighting and railway engineers and contractors, electric railways, central stations and isolated plants. Have well-equipped office, telephone, etc., with room to carry small stock. Arrangement can be made on commission basis, or otherwise, as preferred. Address

S. N.,
Care The Electrical Engineer,
120 Liberty St., New York.

WANTED.

Second-hand constant current, shunt wound dynamo to give about 1,000 amperes at 30 volts State maker's name, lowest price, condition, etc Address

THE LAKE SUPERIOR POWER CO.,
Sault Ste. Marie, Ontario, Canada

WANTED.

The services of a draughtsman, who is competent to make LINE DRAWINGS for books, catalogues, etc. State age, name of last employer, compensation, and submit sample of work. Address

S. S. ..
Care The Electrical Engineer,
120 Liberty Street, New York City.

FOR SALE.

Fully equipped factory for manufacturing dynamos and motors, etc., with full line of patterns, drawings and all necessary data; will stand thorough investigation; good reasons for selling will be given. Address.

S.,
28 Rodney Street, Brooklyn, N. Y.

FOR SALE.

At a Bargain.

2 9"x12" N. Y. Safety Steam Power second-hand engines.
2 25 K. W. second-hand Edison bipolar dynamos.
All of the above in service at present time.
Sold separately or together.
1 15 K. W. second-hand bipolar Edison dynamo.

F. A. Wunder,
115 Broadway, New York.

TELEPHONE.

SPRINGFIELD, O.—The Springfield Telephone Co. has been incorporated by I. Ward Frey, Robert C. Gotwald, C. H. Pierce, Edward C. Glynn and Robert Mills to operate a telephone system on $50,000 capital, in Springfield.

BENTON, ILL.—The Youngblood-Stamper Telephone Co. has been formed; capital stock, $12,000; incorporators, R. A. Youngblood, F. H. Stamper, Winnie H. Youngblood.

GREENCASTLE, IND.—The Putnam County Telephone Co. has been formed; capital, $10,000; incorporators, Clement C. Hurst, Jesse Richardson and Frank G. Gilmore.

STELLA, NEB.—The Interstate Telephone Co. has completed its line into Stella and is extending it north, expecting to reach Nebraska City before laying off the workmen for the winter.

ASHLAND, O.—The People's telephone line at Lodi has been sold to the Ashland Home Co., a company composed of 12 Ashland business men. Consideration named was $30,000.

ELECTRIC LIGHT.

CLARENDON, ARK.—J. W. B. Robinson is president of the Clarendon Light and Heat Co., capital $6,000.

SANTA MONICA, CAL.—The Santa Monica Electric and Power Co. has offered to maintain 35 or more 2,000 c. p. arc lamps for $9.50 per month each. Attached to the bid are two conditional propositions. One of these is to furnish current free of extra charge for the operation of a storage battery for the fire alarm system, on condition that the city purchase the necessary battery and apparatus. The other proposition was to care for the city fire alarm system for an additional compensation of $10 per month.

WEST SALEM, WIS.—For some time the village of West Salem has been having trouble with its electric light system, and there was a strong sentiment in favor of the village putting in its own plant. A contract has now been entered into with Dr. E. C. Swarthout, of La Crosse, for 60 32 c. p. incandescent street lamps.

UTICA, N. Y.—The establishment of Hugh Glenn & Co. is now equipped with a complete isolated electric light plant. A new Westinghouse multipolar dynamo for 500 incandescent lamps has just been installed in the engine room. There are also two bipolar Edison machines, each one capable of 325 incandescent lamps.

CANANDAIGUA, N. Y.—At the regular meeting of the Canandaigua Board of Trustees, the application of M. D. Munger and others for a franchise, to operate an electric light plant in Canandaigue, was turned down.

WALLACE, IDAHO.—The Wallace Mfg., Electric and Water Co. has installed a new five-ton dynamo. This is considerably larger than the old one, which is also being retained in use, so that the light producing power of the plant is considerably more than doubled.

WAYNE, NEB.—The electric light system has started up here and promises to be entirely satisfactory in every respect. The entire city and most of the business houses are lighted.

BLAIRSVILLE, PA.—The borough of Blairsville, Indiana County, has just concluded a contract with the Citizens' Heat, Light and Power Co., of that place, for the lighting of the streets of that borough with electricity. The contract provides for not less than 35 arc lights, normal power 2,000 candles each, at a cost of $70 per annum per light, making a total outlay of $2,450 per year. The contract is to last five years.

ELECTRIC RAILWAYS.

PORTSMOUTH, N. H.—The Boston & Maine Railroad Co. is erecting at Portsmouth, N. H., a building for its electric power station. The building is 118 feet wide and 64 feet long, divided into two rooms—one for the boilers, and the other for the engines and electric generators. The side walls are of brick, the roof construction fireproof; the trusses are of steel, and they support steel beams for the purlins on which is to be placed a concrete roof. The contract for the steel work was given to the Berlin Iron Bridge Co.

GLOUCESTER C. H., VA.—The Board of Supervisors has voted a subscription of $30,000 to the Richmond & Tidewater Railroad Co., if the road is built from Richmond to Gloucester Point.

LEAVENWORTH, KAN.—The county commissioners of Leavenworth County have granted a franchise to the company which purposes building an electric railway from Leavenworth to Kansas City.

NEW YORK, N. Y.—Judge Cohen, of the Supreme Court, has granted an order discharging Arthur Ingraham as receiver of the Electric Railway Co., of 1 Broadway. He was appointed receiver in January, 1897. The assets realized $3,944 and the debts proved amount to $29,141.

BALTIMORE, MD.—J. G. White & Co., street railway contractors, have broken ground at Tome and Third streets, Canton, for a trolley road connecting the Green Line terminus of the Baltimore City Passenger Railway with the Middle River Railway at Highlandtown.

TORRINGTON, CONN.—The Torrington & Hartford Tramway Co. gives notice that it will apply to the General Assembly for permission to extend its lines southward from the east branch in Torrington to East Litchfield and westward from there to Bantam Lake.

POTTSTOWN, PA.—The Montgomery & Chester Electric Railway, to which a charter has just been granted, will shortly begin the construction of a trolley line between Phœnixville and Spring City. The line will be extended to Royersford, Limerick Square and Pottstown, and possibly from Phœnixville to Valley Forge, and from Pottstown to West Chester. John J. Ridgway, of Philadelphia, is president of the company, and the incorporators are Daniel S. Mann, William H. Grebe and Claud S. Jarvis, of Philadelphia; George F. P. Wanger, of Pottstown, and J. G. MacPherson, of Washington, D. C. The capital stock is $300,000.

PITTSBURG, PA.—The United Traction Co. will extend its California avenue, Allegheny, branch, from Avalon to Dixmont, if a favorable ordinance granting it permission through the borough of Ben Avon is passed.

ALLIANCE, O.—There is a well grounded report that the Canton & Alliance Electric Railway Co. is negotiating for the purchase of the Alliance street railway. The local line is about four miles in length and its purchase would give the Canton & Alliance Co. the right of way over the principal streets of the city. The Canton & Alliance Co. have secured the right of way for an electric line between this city and Canton, a distance of 18 miles, and the line will be built within the next six months.

See further, page xxi.

Digitized by Google

ALL APPARATUS IN STOCK FOR IMMEDIATE DELIVERY.

110 Volt Dynamos.

1 50-light Jenney.
1 55 " Edison.
1 55 " E. & C., Multipolar.
1 99 " Westinghouse.
1 140 " Ft. Wayne Jenney.
2 150 " Eddy.
1 200 " Western Electric.
1 250 " Thomson-Houston.
2 270 " General Electric, direct connected to Case engine.
1 280-light General Electric, M. P.
1 325 " Amer. Eng. Co., M. P.
4 350 " Edison, 20 K. W.
1 425 " United States.
2 480 " Brush.
1 546 " Edison, 30 K. W.
1 800 " Rockford.
1 1000 " Jenney.
1 1000 " Edison, 60 K. W.
2 1500 " Edison, 100 K. W.

220 Volt Dynamos.

1 7 K. W. E. & C. Multipolar.
1 8½ " Fisher, M. P.
1 12 " Edison.
1 15 " T.-H.
1 20 " Edison.
1 20 " T.-H.
1 20 " Amer. Eng. Co., M. P.
1 25 " Rockford.
1 75 " Eddy, M. P.

500 Volt Generators.

1 15 K. W. Edison.
1 18 " Commercial.
1 18 " E. & C., Multipolar.
1 25 " Rockford.
1 25 " General Electric, direct connected.
1 30 " Jenney.
2 100 " Edison, No. 32.
1 150 " Westinghouse, M. P.

Alternators.

1 350-light T.-H., A 18.
1 400 " T.-H., Iron Clad.
1 500 " Standard, 30 K. W.
1 500 " Bain.
1 500 " Westinghouse, No. 0.
1 600 " T.-H., 30 K. W., 2-phase.
1 600 " Westinghouse, 30 K. W., toothed armature.
3 650 " T.-H., A 35.
3 750 " Westinghouse, 37½ K. W.
3 750 " Westinghouse, self oilers.
1 900 " Westinghouse, 45 K. W. toothed armature.
1 1000 " Westinghouse, 2-phase, toothed armature, 50 K. W.
2 1300-light Slattery.
3 1500 " Westinghouse, 75 K. W.

BARGAINS.

Arc Dynamos.

1 20-light 1200 c. p. Excelsior.
1 20 " 2000 " Excelsior.
1 20 " 2000 " Western Elec.
1 20 " 2000 " Brush.
1 25 " 2000 " T.-H.
1 25 " 1200 " Fort Wayne Wood.
1 30 " 1200 " T.-H., K 12.
1 30 " 2000 " T.-H., M 2.
3 30 " 2000 " Brush.
2 35 " 2000 " T.-H., L. D. 2.
1 40 " 2000 " Western Elec.
2 45 " 1200 " T.-H., M 12.
4 45 " 1200 " Brush, No. 7.
1 50 " 1200 " T.-H., L. D. 12.
1 50 " 1200 " Standard.
1 50 " 2000 " Standard.
1 50-light 2,000 c. p. Brush, No. 7½.
1 50 " 2000 " Excelsior, new type.
2 50 " 2000 " T.-H., M. D., self oiler.
6 65 " 2000 " Brush, No. 8.
1 100 " 2000 " Western Elec.

110 Volt Motors.

2 ¼ H. P. Sprague.
1 3 " Jenney.
1 3 " E. & C., Multipolar.
1 7½ " Westinghouse.
2 10 " Eddy.
1 12 " Western Electric.
1 20 " General Electric, M. P.
1 25 H. P. Thomson-Houston.
4 25 " Edison, 20 K. W.
1 25 " Amer. Eng. Co., M. P.
1 35 " Edison, 30 K. W.
1 50 " Rockford.
1 75 " Jenney.
1 75 " Edison, 60 K. W.
2 125 " Edison, 100 K. W.

220 Volt Motors.

1 ¾ H. P. Hawkeye.
1 1 " C & C.
1 3 " E. & C., Multipolar.
1 4 " Edison.
1 6 " Bernard.
1 7½ " E. & C., Multipolar.
1 10 " Belding.
1 10 " Eddy.
1 10 H. P. Fisher, M. P.
2 15 " Eddy.
1 15 " Edison, 12 K. W.
1 18 " T.-H.
1 25 " T.-H.
1 25 " Edison.
1 25 " Amer. Eng. Co.
1 30 " Rockford.
1 100 " Eddy, M. P.

500 Volt Motors.

1 1 H. P. Westinghouse.
1 1 " Eddy.
1 2 " Crocker-Wheeler.
1 3 " Jenney.
1 4 " Edison.
1 5 " Wood.
1 5 " Westinghouse.
1 5 " Detroit.
1 7½ " T.-H.
1 7½ " Commercial.
1 7½ " Edison.
2 7½ " E. & C., Multipolar
1 10 " Card.
1 10 " Eddy.
2 12 " T.-H., D 10.
1 15 " Mather.
1 15 " Card.
1 18 " Edison, 15 K. W.
1 20 " Commercial.
1 22 " E. & C., Multipolar.
1 30 " Rockford.
1 30 " E. & C., Multipolar.
1 35 " Jenney.
2 125 " Edison, No. 32.

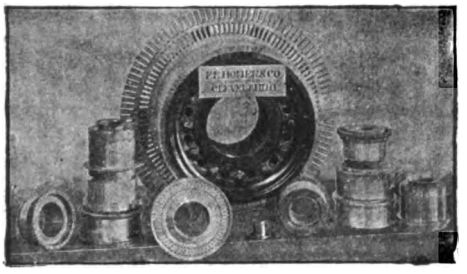
Alternating Motors.

1 ½ H. P. Stanley, single-phase.
1 2 " Stanley, 2-phase.
6 3 " Westinghouse, 2-phase.
1 20 " Gen. Elec., Monocyclic.
1 30 " " " "
1 50 " " " "

Large lot of **TRANSFORMERS** of standard makes, also **ARC LAMPS**. All kinds of **INSTRUMENTS, METERS, SWITCHES, WIRE, SUPPLIES.** Send for our monthly **BARGAIN SHEET**, giving complete list with **NET PRICES.**

CHAS. E. GREGORY COMPANY,

60-62-64 So. Clinton St., CHICAGO.



COMMUTATORS MOTOR, GENERATOR and SPECIAL

Built, Refilled and Repaired for any type of machine.

WE GUARANTEE OUR WORK SATISFACTORY.

F. E. HOMER & CO.,

BRUSH BUILDING, CLEVELAND, O.

Talk About Prices!

Having purchased the entire available assets of the Cornman Company, assigned, and of The Cleveland Electric Trading Company, we have now on hand a large amount of alternating and direct current and arc apparatus, as well as a large stock of lamps, station supplies, construction supplies, etc., which we desire to close out at once.

We have bought Cheap, and we are willing to sell Cheap.

We expect to have on hand from time to time, considerable apparatus of this sort. It is our purpose, however, to act as contracting engineers and manufacturers' agents, and we are fitted to handle anything in the way of electrical and steam installations.

Write us regarding your contemplated improvements. **GET OUR PRICES ON MACHINE SUPPLIES.**

THE PELTON ENGINEERING COMPANY, - CLEVELAND, O.

FINANCIAL.

CARTHAGE, MO.—The city has voted a bond issuance for $25,000 to build an electric light plant. Address the mayor.

TAUNTON, MASS.—The Taunton & East Taunton Street Railway has received permission to issue $50,000 original stock. The roadbed, about four miles, will cost $33,000; the overhead construction $8,000, and the rolling stock $9,000. J. P. Dunn, Taunton, is interested.

WEST ROXBURY, MASS.—The Massachusetts Railroad Commissioners have authorized an increased issue of $100,000 stock and $50,000 5 per cent. 20-year bonds by the West Roxbury & Rosslindale Street Railway Co. The increased issue is for funding the floating debt for extensions and equipment.

WARREN, O.—The Warren and Niles Telephone Co. was authorized to increase its capital stock from $50,000 to $75,000.

DAYTON, O.—Stockholders of the Dayton, Springfield & Urbana Electric Railway Co. have increased the capital stock of the company from $10,000 to $750,000.

See further page xxii.

Digitized by Google

REWINDING-REPAIRING

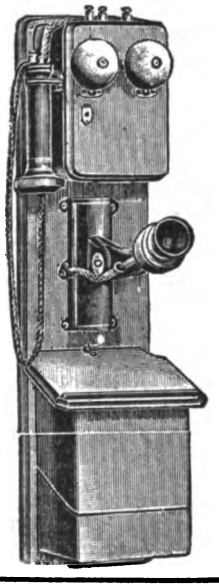
We have a perfectly equipped Repair Shop and Expert Workmen. Work Guaranteed . . .

COMMUTATORS MILLER-KNOBLOCK LONG LIFE

In the assembled form carried in stock for all Standard Railway Motors. We refill all kinds of Commutators.

THE MILLER-KNOBLOCK COMPANY.
SOUTH BEND, INDIANA.

TELEPHONES



As Shown in Cut

$7.25 Each.

With Double Battery Box .....$7.75 each
Short Distance Magneto Call Telephones .. ..$5.00 each
Battery Call Telephones .....$2.75 each

ALL TELEPHONES HIGH GRADE AND FIRST CLASS IN EVERY RESPECT.

Send for complete catalogue of

ELECTRICAL SUPPLIES.

Mianus Electric Co.
MIANUS, CONN.

Peru Electric Mfg. Co.,
Peru, Indiana,

Manufacturers of

Porcelain Sundries of every description.

Main and Branch Cutouts, Porcelain Knobs, Cleats, Tubes, Rosettes, Switches, Wall Receptacles, Motor Cutouts, etc., etc.

BATTERIES OF OUR SUPERIOR MAKE:

LACLEDE AND HERCULES.

We take orders for PORCELAIN SPECIALTIES in Quantities.

WRITE FOR CIRCULAR.

....IN....

FIELD Winding

WE LEAD THE WORLD

Factory Prices Are Not In It With Us.

HUNDREDS OF TONS of **COAL SAVED** by using

GREEN'S ECONOMIZER

SOLE MAKERS IN THE UNITED STATES,

THE FUEL ECONOMIZER CO.

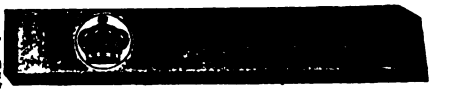
OFFICES:
MATTEAWAN, Head Office.
NEW YORK, 74 Cortlandt Street.
BOSTON, 53 State Street.
CHICAGO, 1105 Monadnock Block.
SAN FRANCISCO, 32 First Street.

OF

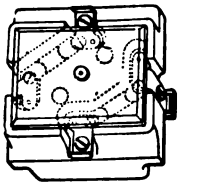
MATTEAWAN, N. Y.

OUR **CROWN BRUSH.**

Made flexible end-ways side-ways or stiff. Send for samples and price list and compare with other makes.



CROWN WOVEN WIRE BRUSH CO., - SALEM, MASS.



MAKING CUT-OUTS OUR SPECIALTY

Write for full particulars, etc. 26 styles of Open and Covered.

CUT-OUTS

Money saved is money earned.

H. T. PAISTE CO.
CHICAGO PHILADELPHIA

INCANDESCENT LAMPS RENEWED.

Manufacturers of new lamps. Either *NEW* or *RENEWED* lamps exchanged for burned out lamps.

LYNN INCANDESCENT LAMP CO.,
Lynn, Mass.

Incandescent Lamps RENEWED.

GEO. K. HAMBLIN, - - - 4 Peck Slip, NEW YORK.

THIS 'PHONE $5. Others from $2.65 to $15.

For further information write to

Stone City Telephone Mfg. & Const. Co.
JOLIET, ILL.

ELECTRIC POWER.

LEADVILLE, COLO.—Articles of incorporation of the Leadville Water Works Co. have been filed. The incorporators are C. W. Priddy, Andrew N. Dix and B. L. Carr. The company is formed to acquire by purchase all the property and franchises of the Leadville Water Co. for supplying the city of Leadville with water for fire and domestic purposes; to erect plants for the generation of electricity and the compression of air. The company is capitalized for $400,000. Its directors are Henry B. Cleaves, D. B. Wesson, W. E. Hawks, C. N. Priddy and W. W. Mason.

INDIANAPOLIS, IND.—A large power house is now being designed for John H. Murphey, which is intended for small manufacturing concerns that require power and light in limited space.

See further page xxvi.

Digitized by Google

Western Electrical Supply Co
St. Louis, U.S.A.

NO ELBOWS REQUIRED

BEST INSULATION

EASIEST TO WORK

5 GOOD POINTS OF

"LORICATED"

Iron Armored Conduit.

Approved By Underwriters.

Prompt Shipments From Stock.

INDESTRUCTIBLE

LOWEST PRICED

Wholesalers, Importers and Jobbers of Everything Electrical.

Digitized by Google

IT IS OUR AIM

All apparatus guaranteed. Does not infringe.

To give the best instrument for a reasonably low price consistent with first-class workmanship and highest grade materials, hence the introduction of

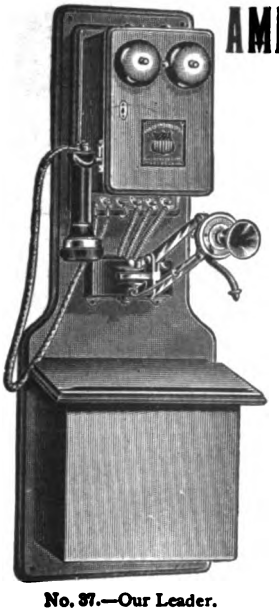
VICTOR DOUBLE POLE RECEIVER.

Note its points of superiority and then reflect. Powerful compound horseshoe magnets. Hard rubber cases. Adjustment perfect. Highest quality Tungston steel. No metal parts. Spool wound with No. 36 silk covered wire. All connections soldered and thoroughly insulated.

DOES THIS APPEAL TO YOU?

THE VICTOR TELEPHONE MFG. CO.

166 to 174 S. CLINTON ST., CHICAGO.



No. 37.—Our Leader.

AMERICAN ELECTRIC TELEPHONE COMPANY,

171-173 So. Canal St.,
CHICAGO, ILL.

The Largest Manufacturers of

Telephones and Switchboards

In the United States.

ALL GOODS STRICTLY HIGH GRADE

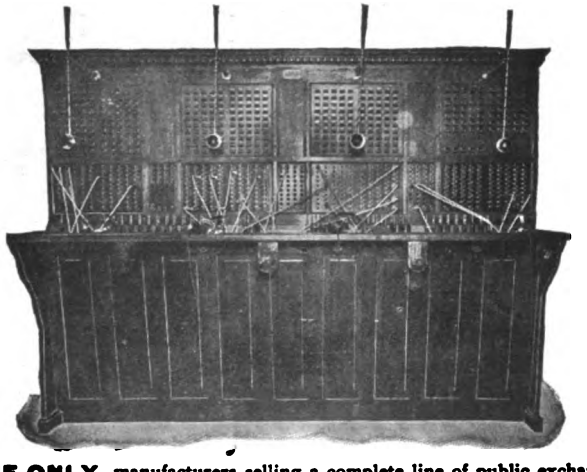
Five Hundred Exchanges, Aggregating One Hundred Thousand Telephones in use. Four Years Service.

Write for New Catalogue, showing New Types and Prices.

THE STROMBERG CARLSON TELEPHONE MFG. CO.

72-82 W. Jackson Blvd.,
CHICAGO, U. S. A.

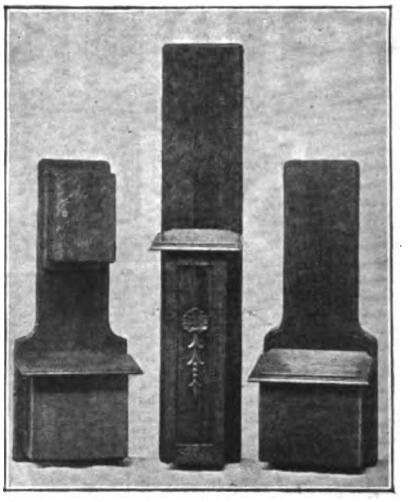
RAPID, DURABLE.



NON-INFRINGING.

THE ONLY manufacturers selling a complete line of public exchange, Toll Line, Police, Fire Alarm, Street Railway, Express, Central Station and Intercommunicating Private plant Equipment fully protected by patent. We respect all patent claims of others. **SEND FOR CATALOG.**

HELLO!



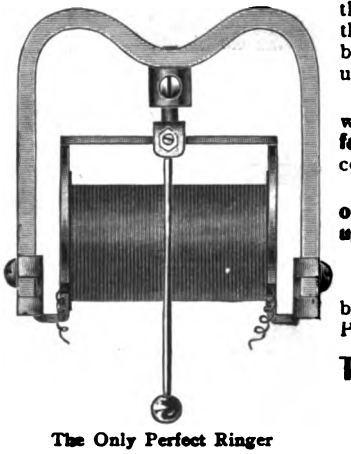
Who Leads in TELEPHONE WOOD SPECIALTIES?

Cabinet Manufacturing & Supply Co.,

CLEVELAND, - - OHIO.

We Are Patiently Waiting.

Our Single-Core Ringer.



The Only Perfect Ringer

The **infringement howlers"** have threatened to bring **more** suits—thus far they have **disappointed** us but we have not **altogether** given up hope.

Can the public be in sympathy with methods which employ a **false** cry of **infringement** to deceive them?

Do not longer buy **cheap, out-of-date** apparatus, buy **modern up-to-date** apparatus.

We have it at **reasonable** prices.

Our Magneto Bells, Switchboard Generators and new Double Pole Receivers **lead the world.**

The Williams Electric Co.

80-84 Seneca St.,
CLEVELAND, O.

Magneto Bell No. 3.

WHOLESALE
Telephones and Magneto Bells.
HIGH GRADE.

Magneto Bell No. 1.

Farr Telephone & Cons. Supply Co.

No. 357 DEARBORN STREET, CHICAGO.

INTERIOR TELEPHONES

Our Circulars and Illustrations explain in detail. Send for them.

THE ALLEN-HUSSEY CO., 213 RANDOLPH ST., CHICAGO.

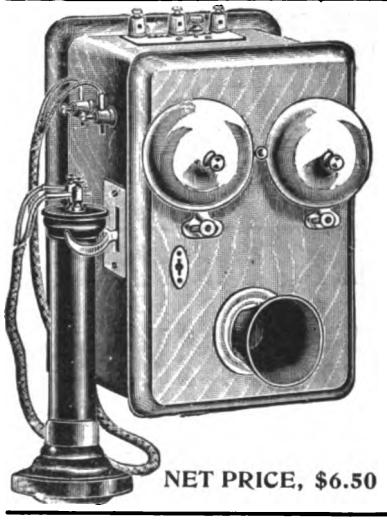
When writing Advertisers, kindly mention THE ELECTRICAL ENGINEER

Digitized by Google

THE AMERICAN BELL TELEPHONE COMPANY.

125 MILK STREET, BOSTON, MASS.

THIS Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined telegraph and telephone, covering all forms of microphone transmitters or contact telephones.



NET PRICE, $6.50

NOW READY.

CATALOGUE No. 10.

A New Pocket Battery Gauge, to retail **$3.50,** is now ready.

Something New in Burglar Alarm Traps now ready. A lot of specialties we are now making can be purchased at the right price.

THE MESCO DRY BATTERY (better than ever). Prices to suit buyers who are using cheaper grades.

Manhattan Electrical Supply Co.

32 CORTLANDT STREET, NEW YORK

NEW TELEPHONE

For Railroad and Trolley, Linemen and General Testing Purposes it is Indispensable.

SIMPLE, COMPACT, COMPLETE, STRONG

WEIGHT ONLY 9 LBS.

WRITE FOR PARTICULARS.

VIADUCT MFG. CO., BALTIMORE, MD.

Plans for the New York Soasen

should include

Tolophone Service at your Rosidenco.

Its convenience is inestimable

Its cost is inconsiderable.

NEW YORK TELEPHONE COMPANY,
15 Dey St., 952 Broadway, 115 West 38th St.

POLES OCTAGONAL AND ROUND. TROLLEY AND STEAM. TIES

D. W. PHELAN, 280 Broadway, New York.

Western Telephone Construction Co.,

250-254 S. CLINTON STREET, CHICAGO, ILL.

Largest Manufacturers of

TELEPHONES AND SWITCHBOARDS EXCLUSIVELY IN THE UNITED STATES.

THE KOKOMO

TRANSMITTER.

FINEST TALKER ON EARTH.

Especially for Exchange and Long Distance Service.
We manufacture Switchboards, all styles of Telephones and everything to equip an exchange.
Send for illustrated Catalogue.

KOKOMO TELEPHONE & ELECTRIC MFG. CO.,
Kokomo, Ind., U. S. A.

F. R. HARRIS,

Manufacturer of

WIRE

Spring and Electric.

FINE BRASS, COPPER, GERMAN SILVER, Phosphor Bronze Wire.

SPECIAL ALLOY WIRE DRAWN TO ORDER.
35 BENEDICT ST., WATERBURY, CONN.

Weston Electrical Instrument Co.,
114-120 William Street, Newark, N. J.

AMMETERS and VOLTMETERS

For Central Stations and Isolated Plants.

A new, profusely illustrated Catalogue just published.

Digitized by Google

THE PELTON WATER WHEEL COMPANY

Give exclusive attention to the development and utilization of water powers by the most modern, economic and improved methods.

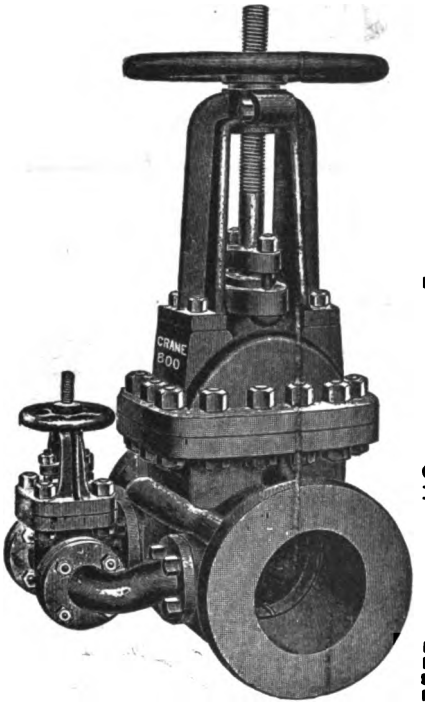
An experience of more than fifteen years, involving both the theory and practice of hydraulic engineering as relates to power development in its widest range of application, is at the service of its customers. NINE THOUSAND WHEELS NOW RUNNING, aggregating some 700,000 H. P.

ELECTRIC POWER TRANSMISSION.

Pelton Wheels afford the most reliable and efficient power for such service, and are running the majority of stations of this character in the United States, as well as most foreign countries.

Highest efficiency and absolute regulation guaranteed under the most extreme variations of load Catalogues furnished on application. Address

121 Main Street, San Francisco, Cal., U. S. A. **PELTON WATER WHEEL COMPANY,** 143 Liberty Street, New York City, U. S. A.



Crane Company,

CHICAGO.

MANUFACTURERS OF

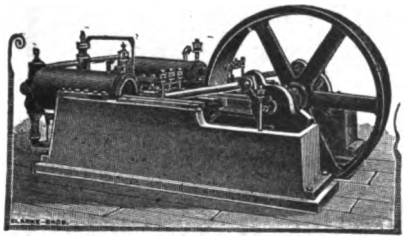
HIGH PRESSURE
GATE VALVES
PIPE AND FITTINGS.

Complete Piping Equipments Cut and Fitted ready for Erection.,
Over Twenty Large Power Houses Equipped complete during the past year. All giving perfect satisfaction

BRANCH HOUSES:

NEW YORK, KANSAS CITY, ST. PAUL, PORTLAND, ORE., PHILADELPHIA, OMAHA, LOS ANGELES, SIOUX CITY, SAN FRANCISCO

A GAS ENGINE THAT REGULATES.



3 per cent. regulation GUARANTEED from no load to full load.

Sizes 25 to 150 H. P. in use.
Belted or direct-coupled units.

Send for Circular.

Miller Improved Gas Engine Co., Springfield, OHIO.

REG. TRADE MARKS
"Phosphor-Bronze" DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED;
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
— DELTA METAL —
CASTINGS, STAMPINGS AND FORGINGS.
ORIGINAL AND SOLE MAKERS IN THE U.S.

No. 189 IRON BOX BELL

DOES GOOD WORK BECAUSE IT IS WELL MADE NON-TURNING, BINDING AND CONTACT POSTS, AND DOUBLE ADJUSTMENT.

A Very Desirable Bell at a Low Price.....

Huebel & Manger, Manufacturers. 286 GRAHAM ST., BROOKLYN, N. Y.

W. C. YOUNG MFG., CO.
MANFRS. & EXPORTERS OF
LATHES, PUNCHES AND SHEARS.

TELEGRAPH ADDRESS YOUNG, WORCESTER, WESTERN UNION CODE USED.

WORCESTER, MASS., U.S.A.

EUROPEAN AGENCIES:
ELIG. SONNENTHAL & Co., London. | E. SONNENTHAL, Jr. Berlin.
H. W. PEABODY & Co., Paris. | JOSEF SCHVARCZ, Budapest.

THE PRACTICAL
ELECTROPLATER.

A comprehensive treatise on Electroplating, with notes on ancient and modern gilding and formulas for new solutions.

BY
MARTIN BRUNOR.

298 PAGES, FULLY ILLUSTRATED, SECURELY BOUND IN CLOTH AND HALF MOROCCO.

PRICE, $6.00.

Sent on receipt of price by
The Electrical Engineer
120 Liberty Street, NEW YORK

Matter, Energy, Force & Work.

BY
Prof. SILAS W. HOLMAN,

12mo. Cloth. 257 pp.
Price $2.50.

The Electrical Engineer
120 Liberty St.,
NEW YORK CITY.

ELECTRIC LIGHT.

TRENTON, N. J.—Thomas C. Barr, of Orange, and Col. A. R. Kuser, of Trenton, have purchased the stock and franchise of the Trenton Electric Light and Power Co. The price paid is understood to be $116,000. It is believed that the purchase is part of a plan for consolidating the Electric Light Co. with the Trenton Passenger Street Railway Co.

CHARLOTTE, MICH.—The streets will be again lighted before long, after being in darkness for 10 months because of a disagreement between the lighting company and the city council. The trouble has been settled, and the lights will be turned on Jan. 1.

BRADFORD, PA.—The Bradford Electric Light Co. has been formed; capital, $10,000; incorporators, Robert Thompson, D. J. Phenix, E. P. Deyo, J. P. Code.

SWEDESBORO, N. J.—The Swedesboro Light, Heat and Power Co. has been formed; principal office, Woolwich Township, Gloucester County; to manufacture electricity for light, heat and power; capital, $25,000; incorporators, Charles D. Lippincott, Henry W. Ridgway, George B. Mitchell, Thomas B. Turner, John C. Rulon, Benjamin P. Lawrence, James J. Davidson.

HAGERSTOWN, MD.—E. M. Schindel, mayor, has signed the ordinance authorizing the establishment of a municipal plant, at a cost of $80,000. The city at present is lighted by the Hagerstown Railway Co., the contract for which will expire in two years.

GIBBSTOWN, N. J.—The Repauno Chemical Co., Repauno, N. J., and 97 Cedar street, New York, has let the contract to the Tucker Electrical Construction Co., 14 Whitehall street, New York, for the entire lighting and power plant for the Repauno works. General Electric machinery will be used. The plant will have about 100 h. p.

Digitized by Google

ANNUNCIATORS AND BELLS

CATALOGUES AND PRICES ON APPLICATION.

PARTRICK, CARTER & WILKINS, 125 So. Second St., PHILADELPHIA, PA.

Supply Parts. Special Work.

HOOHHAUSEN & HALL,

ELECTRICAL CONSTRUCTION AND REPAIRS.

Estimates furnished on all electrical work.

67 Liberty Street, BROOKLYN, N. Y.

Hart H. & H. Push Switch

PATENTED { Nov. 30th, 1897. May 17th, 1898.

Easy to Operate.
Easy to Wire.
Will not get out of Order.
Handsome in Appearance.

SOLD BY ALL ELECTRICAL SUPPLY HOUSES.

Specify it when ordering.

THE HART & HEGEMAN MFG. CO.

216 High Street.
HARTFORD, CONN.

COAL HANDLING IN POWER PLANTS.

This is an interior view of the Metropolitan Street Railway Company (Kansas City, Mo.) boiler room, showing Hunt Noiseless Conveyor and arrangement of chutes for spouting coal direct to the Automatic Stokers. This conveyor, after delivering the coal to the storage bins, which are located over the furnaces, passes underneath the boilers, receives the ashes, and transports them to a tank from which they are readily removed.

This is only one of the many great installations our catalogues describe. Catalogue 9810 treats of "Coal Handling for Steam Generation." We are always glad to send it and any information to interested parties.

Address the Works direct. **C. W. HUNT COMPANY,** WATER ST., WEST NEW BRIGHTON. STATEN ISLAND, N. Y.

WASHBURN & MOEN

MFG. CO. BARE AND INSULATED

ELECTRICAL WIRES

OF EVERY DESCRIPTION

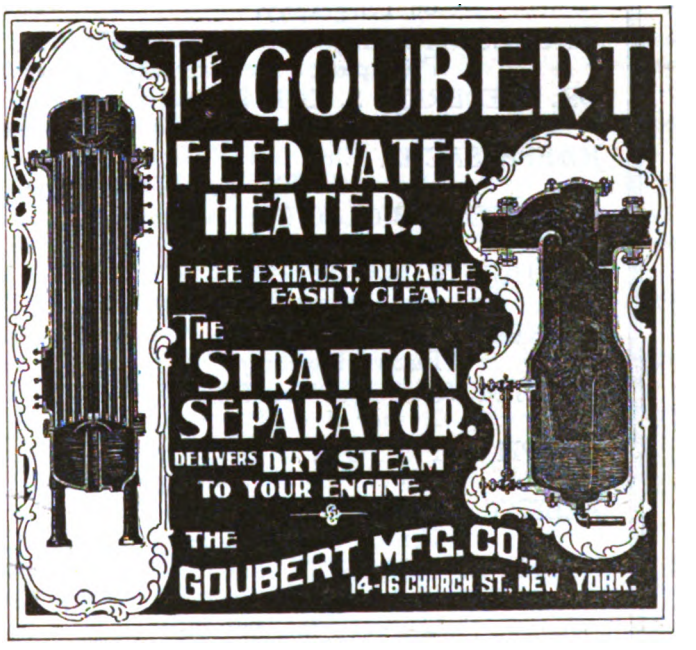
ALSO MANUFACTURERS OF

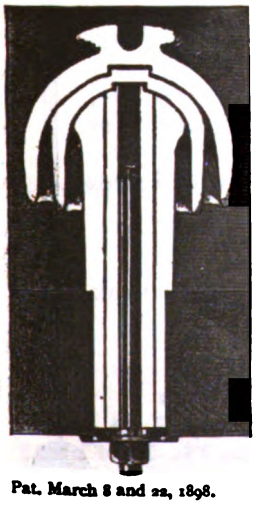
The "Chicago" Rail Bond.

General Offices: WORCESTER, MASS.

WAREHOUSES AND OFFICES:

Boston, New York, Chicago, San Francisco
Houston, Philadelphia, Pittsburgh.





Pat. March 8 and 22, 1898.

"Boch Glaze-Filled"

HIGH VOLTAGE INSULATORS AND PORCELAIN PIN COMBINED.

Any Required Test Guaranteed no matter how high.

Beware of imitations.

Manufactured solely by

THE R. THOMAS & SONS CO.,
EAST LIVERPOOL, OHIO.

Sales Offices, 39 and 41 Cortlandt Street, New York.

BY SIMPLY PRESSING A BUTTON YOU CAN

STOP YOUR ENGINE

Close any valve in your steam pipe. Throw out a friction clutch. Stop a water wheel. Stop a gas or oil engine. Stop anything controlled by valve or lever.

IF YOUR ENGINE STARTS TO RACE OR **RUN AWAY**

THE MONARCH SPEED LIMIT STOPS IT AUTOMATICALLY.

NO FLY wheel accidents.
burnt out armatures or field magnets.
wholesale blowing of fuses.
loss of life in moving machinery.
loss in accident suits due to lack of proper precautions.

THE MONARCH MFG. CO.,
39 Cortlandt Street, New York.

For New England States address Waterbury, Conn.

Digitized by Google

The Foremost Electrical Engineers

of the country have prepared our Instruction Papers. In establishing

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION,

our aim has been to have our Papers prepared by recognized authorities, so that we may now truthfully say

THE STANDARD WE HAVE SET CANNOT BE SURPASSED.

The following eminent authorities are among those who have prepared papers:

PROFESSOR FRANCIS B. CROCKER, Past President American Institute of Electrical Engineers. Professor of Electrical Engineering at Columbia University. Author of our Instruction Papers on **Design of Continuous Current Machinery.**

CHARLES F. SCOTT, Chief Electrician, The Westinghouse Electric and Mfg. Co. Author of our Instruction Papers on **Alternating Current Apparatus.**

PROF. W. J. HERDMAN, of University of Michigan, Ann Arbor, Mich. Author of our Papers on **Electro-Therapeutics.**

ELMER G. WILLYOUNG, The well-known Electrical Instrument Expert and Manufacturer. Author of our Instruction Papers on **Instruments and measurements** and **X-Ray Apparatus.**

WILLIAM MAVER, JR., Author of "American Telegraphy." Author of our Instruction Papers on **Telegraphy.**

THORBURN REID, The well-known Consulting Electrical Engineer. Author of our Papers on **Principles of the Alternating Current.**

DR. FREDERICK S. KOLLE, Radiographer to the Methodist Episcopal Hospital of Brooklyn. Author of our Papers on **Medico-Surgical Radiography.**

JOSEPH SACHS, Electrical Bureau, Department Public Buildings, New York. Author of our Papers on **Wiring and Distribution.**

TOWNSEND WOLCOTT, Consulting Electrical and Mechanical Engineer. Author of our Papers on **Primary Batteries.**

ARTHUR N. MANSFIELD, The well-known authority in telephony, with American Telephone and Telegraph Co. Author of our Papers on **Telephony.**

ALFRED E. WIENER, The well-known Electrical Engineer and Author. Author of our Papers on **Electric Lighting.**

HUGH MORRISON WHARTON, Electrical Engineer, with Westinghouse Electric and Mfg. Co. Author of our Papers on **Continuous Current Machinery.**

JOSEPH APPLETON, Chief Engineer of Construction, The Electric Storage Battery Co. Author of our Papers on **Storage Batteries.**

ALBERT B. HERRICK, The well-known Central Station Expert. Author of our Papers on **Central Station Construction and Operation.**

RALPH D. MERSHON, The well-known Expert in Alternating Current Transmission, with the Westinghouse Electric and Mfg. Co. Author of our Instruction Papers on **Alternating Current Transmission.**

J. LESTER WOODBRIDGE, The well-known Authority. Author of our Papers on **Electric Railways.**

THOMAS HALL, Superintendent of the Mansfield Machine Works. Author of our Instruction Papers on **Thermodynamics, Steam Engines and Steam Boilers.**

G. B. PRESTON, Department of Experimental Engineering, Sibley College, Cornell University, Ithaca, N. Y., Author of our Instruction Papers on **Strength of Materials.**

DR. SAMUEL SHELDON, Professor of Physics and Electrical Engineering, Polytechnic Institute, Brooklyn, N. Y. Author of our Instruction Papers on **Electricity and Magnetism for Physicians.**

HERMAN A. STRAUSS, Electrical Engineer. Author of our Papers on **Design of Switchboards and Switchboard Instruments.**

THOS. J. FAY, Electrical Engineer. Author of our Papers on **Applied Mechanics.**

For full information relating to our courses of instruction and our free book entitled ***"CAN I BECOME AN ELECTRICAL ENGINEER,"*** address,

THE ELECTRICAL ENGINEER INSTITUTE OF CORRESPONDENCE INSTRUCTION,

HERMAN A. STRAUSS, E. E.,
General Manager.

120 Liberty Street, New York, U. S. A.

Digitized by Google

OUR COURSES OF INSTRUCTION ARE....

Designed to Meet Your Individual Need.

The following elaborate series of general and special courses makes it easy for any ***student, scholar, merchant, clerk, professional*** or ***laboring man*** to

SELECT HIS OWN COURSE.

Our courses are Guaranteed Scientifically Accurate and are ***Endorsed by Every Prominent Electrical Engineer.***

Instruction Payable in Instalments of $2.00 or $5.00 per Month.

JUNIOR COURSE, a general technical course in Electrical and Mechanical Engineering adapted to the requirements of most technical men.

SENIOR COURSE, the equivalent of a college education in electrical engineering; the most complete course of its kind ever offered.

ADVANCED SENIOR COURSE, recommended to graduated electrical engineers as the means of bringing their knowledge up to date; or to civil, mechanical, and other engineers to rapidly acquire an electro-technical education.

TELEPHONY, Special Course No. 1—The only complete exposition of modern telephone practice.

TELEGRAPHY, Special Course No. 2—Has found the approbation of all telegraphers.

ELECTRIC LIGHTING, Special Course No. 3—A course of exceptional value.

ELECTRIC RAILWAYS, Special Course No. 4—Unsurpassed in scope and treatment.

ELECTRIC MINING, Special Course No. 5—Educates Engineers to a Special Branch wherein Opportunities Go Begging.

ELECTRIC HEATING, Special Course No. 6—A comprehensive treatment of this important study.

ELECTRIC WELDING, Special Course No. 7—Of growing importance.

ELECTRIC SIGNALING, Special Course No. 8—This course has found the favor of Railroad, Marine and Military Signalmen.

ELECTRO-METALLURGY, Special Course No. 9—The vast interests in this field are seeking talent.

ELECTRO-CHEMISTRY, Special Course No. 10—This industry is making giant strides.

ELECTRO-PHYSICS, Special Course No. 11—The ideal course for laboratory workers.

ELECTRIC BELL WORK, Special Course No. 12—A humble subject but a popular course.

CENTRAL STATION WORKING, Special Course No. 13—One of our most important courses.

DYNAMO DESIGN, Special Course No. 14—The authors of this course are recognized authorities.

PURE MATHEMATICS—An education in Elementary Mathematics.

MECHANICAL DRAWING—Draftsmen are made,—not born

ELECTRO-THERAPEUTICS, Special Course No. 15—A thoroughly scientific course prepared by one of the high authorities of the country.

MEDICO-SURGICAL RADIOGRAPHY, Special Course 16—A unique course covering thoroughly the use of the X-Rays in Surgery.

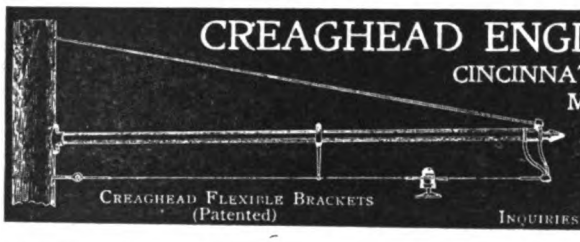
GENERAL COURSE A—a POPULAR exposition of all branches of electricity—no mathematics—A Quick Course.

For more complete information, write for our beautiful little book entitled ***"CAN I BECOME AN ELECTRICAL ENGINEER,"*** and state subject you are particularly interested in. Address

The Electrical Engineer Institute of Correspondence Instruction,

120 Liberty Street, NEW YORK, U. S. A.

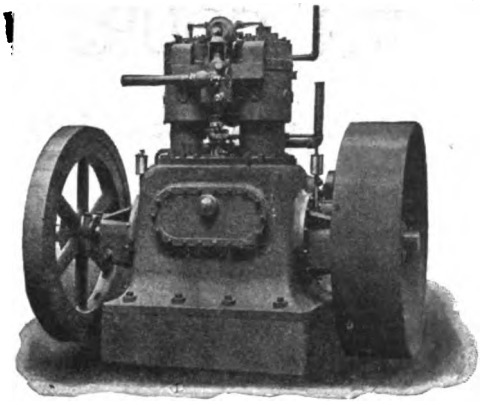
Digitized by Google



CREAGHEAD ENGINEERING CO.,
CINCINNATI, O.
Manufacturers of Line Material.
Arc Light Construction Material,
Creaghead Mast Arms.
CREAGHEAD FLEXIBLE BRACKETS (Patented)
INQUIRIES SOLICITED.

ESTABLISHED A CENTURY AGO.
JESSOP'S STEEL
For TOOLS, DRILLS, DIES, etc.
All Kinds In Stock.
Manufactory, SHEFFIELD, ENG.
Chief Am. Office, 91 JOHN ST., N. Y.
Wm. Jessop & Sons, Ltd

Westinghouse



GAS ENGINES FOR POWER

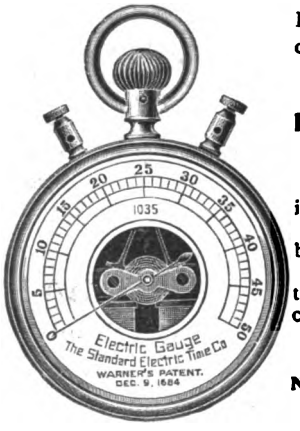
We make them. Our design has been thoroughly tested, and is known to be all that is desired.
Most simple, most economical and satisfactory, because they may be operated by inexperienced persons.
Send for our new catalogue.

Westinghouse { Church, Kerr & Co., Engineers, Machine Co., Manufacturers.

Works at Pittsburg, Pa., and Chicago, Ill.
OFFICES:
New York, Boston, Chicago, Pittsburg, Detroit, Philadelphia.

THE NAME OF Westinghouse IS A GUARANTEE

WARNER'S POCKET BATTERY GAUGE



For testing all kinds of batteries, including storage batteries.

5,000 now in daily use.

Recommended especially for Telephone Inspectors.

The only convenient and practical instrument for the purpose.
It is indispensable to those using batteries and having the care of them.
Warner's Pocket Battery Gauge is the size of an ordinary watch—easy to carry with you.

Price, $5.00. Discount to the Trade.

NOTE.—Extra charge of $1.00 for pocket gauge specially wound for testing single cells of storage batteries.

THE STANDARD ELECTRIC TIME CO., Manufacturers WATERBURY, CONN.

"A Tome That Tells of Tools."

All about every known Tool, large and small, and its uses, size, weight, and present market price. Every Tool described and illustrated by fine and accurate cuts. Send at once for MONTGOMERY & CO.'S thoroughly up to date TOOL CATALOGUE for 1898. 510 pages with index. Pocket size 6¼x4¼, rounded edges and stitched covers. Every foreman of workshop or factory should have a copy. Mailed for 25 cents by

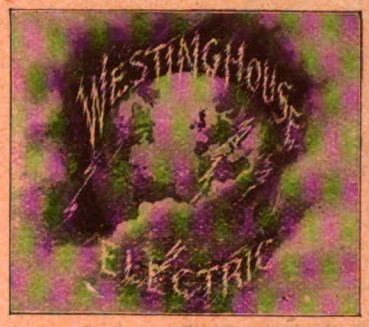
MONTGOMERY & CO.,
105 FULTON STREET, NEW YORK.

Koch Woven Wire Tube Dynamo Brush
GOLDMARK & WALLACE, Agents for U. S.
131 Worth Street, New York.

When writing Advertisers please mention THE ELECTRICAL ENGINEER.

Digitized by Google

Westinghouse



IT STANDS FOR ALL THAT IS GOOD AMONG THE ELECTRICAL PRO= DUCTS OF THE EARTH.

Westinghouse Electric

& Mfg. Co., Pittsburg, Pa.

NEW YORK, 120 Broadway.
ATLANTA, GA., Equitable Building.
AUSTIN, TEXAS.
BOSTON, Exchange Building.
BUFFALO, N. Y., Ellicott Square Building.
CHICAGO, New York Life Building.
CINCINNATI, Neave Building.
PHILADELPHIA, Land Title Building.
PITTSBURG, Westinghouse Building.
ST. LOUIS, American Central Building.
SAN FRANCISCO, Mills Building.
SYRACUSE, N. Y., Bastable Building.
TACOMA, WASH., 907 Pacific Avenue.
DENVER, Mountain Electric Co.
CANADA, AHEARN & SOPER, OTTAWA CANADA.
MEXICO, G. & O. BRANIFF & CO., CITY OF MEXICO.
WESTINGHOUSE ELECTRIC CO., LTD., 32 Victoria Street, LONDON, S. W., ENGLAND.

Digitized by Google

CROUSE-HINDS ELECTRIC CO. SWITCHES.

Main Office and Works, Syracuse, N. Y. New York Office and Warehouse. 23 Dey St.

STEEL SPRING WIRE

OUR MUSIC WIRE HAVING HIGH TENSILE STRENGTH AND ABSOLUTE UNIFORMITY IS EXCELLENT FOR SPRINGS.....

HAMMACHER, SCHLEMMER & CO.,

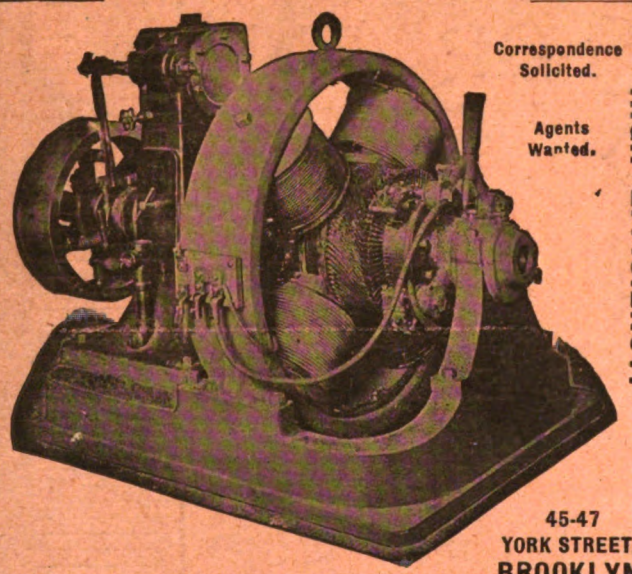
Correspondence Solicited.

Importers

209 BOWERY, NEW YORK.

DYNAMOS RIKER MOTORS

LOW SPEED. HIGH EFFICIENCY.



Correspondence Solicited.

Agents Wanted.

45-47 YORK STREET, BROOKLYN.

OKONITE

TRADE MARK.

THE STANDARD FOR RUBBER INSULATION.

1889—Paris Exposition Medal for Rubber Insulation. *1893—World's Fair Medal for Rubber Insulation.*

. . . Sole Manufacturers of . . .

OKONITE WIRES, TAPE,

Candee Weatherproof Wires, Manson Tape.

THE OKONITE CO., Ltd.,

WILLARD L. CANDEE, H. DURANT CHEEVER, } *Managers.* GEO. T. MANSON, *Gen'l Supt.* W. H. HODGINS, *Sec'y.*

253 BROADWAY, NEW YORK

WRITE TO

FERRACUTE MCH. CO.

BRIDGETON, N. J., U.S.A.

FOR CATALOGUE OF

PRESSES, DIES

And other Sheet Metal Tools for all kinds of

ELECTRICAL WORK,

Especially the Cutting and Notching of

ARMATURE DISCS.

ST. LOUIS, MO.

113 Liberty St. New York, N. Y. 164 Summer St. Boston, Mass. 129 No. Third St. Philadelphia Pa.

EHEBER WELLS,

Pattern Letters For Iron and Brass Castings.

Manufacturers also of . . . *CABINETS FOR ELECTROTYPES.*

155 William Street, New York.

WROUGHT IRON BRIDGE COMPANY

Iron and Steel Bridges, Girders, Turn-Tables, Buildings and Roofs.

F. M. WYANT Treas. and Gen'l Manager

LONG DISTANCE TELEPHONE. WESTERN UNION and POSTAL TELEGRAPH WIRES. CANTON, OHIO.

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google